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EDITORIAL NOTES.

The New Gas Finance.

EARLY in the days of the war, attention was called in the editorial columns of the "JOURNAL" to the question of the necessity for easing the conditions under which gas capital was raised, in view of the prospects of a protracted colossal struggle, huge expenditures, the attractions that would be held out to secure the necessary funds for carrying on the immense conflict, and, finally, when release came from the veto of the Treasury, the competition on inviting terms that there would be for new capital for industrial and trading purposes, and to repair the material mischief of gigantic proportions occasioned by the war. Developments so far have proved the accuracy of the forecast, as was shown by further articles subsequent to the issue of the new 4½ per cent. War Loan, with Government security, and redeemable at par. Since then have come the alluring 5 per cent. Treasury Bonds, which are now being issued to unlimited amount. All this has considerably altered the financial situation, and the standards on which capital can be raised for the soundest of established enterprises. But before hostilities commenced, there was a marked tendency in the direction of higher returns on investments being necessary, and undertakings of all kinds needing capital had to submit to this tendency. Those gas concerns that were under certain conditions which were considered quite good and effective a dozen years or so ago, began to find themselves severely handicapped, in regard to low interest-bearing debenture and preference stocks, and ordinary stocks as well, unless under the sliding-scale good dividends were being declared. Investors absolutely refused to look, for instance, at 3 and 3½ per cent. debenture stocks or 4 per cent. preference stock in trading companies. Gas undertakings are therefore finding it necessary to secure greater liberties by obtaining relief from effete and inapplicable conditions, and to be in a position to offer much better terms, which will obtain favour in the eyes of investors, and so stand a chance in the competition for capital.

We see a very decided movement in this direction in the Bills that have been lodged for the consideration of Parliament in the coming session. In the preamble of the South Metropolitan Gas Company's Bill, it is submitted that, in the circumstances which prevail at the present time, the Company are unable to dispose of their ordinary stock otherwise than at a price less than the nominal amount, and therefore, as well as in certain other respects, the conditions governing the issue of the ordinary stock of the Company are inconvenient and obsolete. Then we have the Newcastle-upon-Tyne and Gateshead Gas Company saying, in the preamble of the Bill they are promoting, that, having regard to the present state of public affairs, it would be to the advantage of the Company and the consumers of gas, and would facilitate the raising by the Company on economical terms of the money required for the purposes of the undertaking, if the Company had larger powers in relation to the creation and issue of debenture stock. Here we have two large and important gas undertakings, widely separated, both with excellent records, both held in high esteem among investors, making the same admission, that the capital-raising position is not now as it used to be, though the two concerns show expansion, and a broader foundation, and a financial condition stronger than ever. Their admissions are significant, and their conditions in this matter are typical. Times have changed in regard to capital provision; and the cast-iron regulations of the past must be modified. Under their existing statutes, neither of these concerns is able to issue stock by auction or tender at a reserve price less than the nominal amount. In certain conditions of the Money Market, or when adverse trading circumstances reign, and dividends are consequently depreciated, this stipulation is an obstacle to the securing of fresh capital. It was found so by several companies long before the war; and it will be found even more so under the new circumstances created by current events. Therefore, the two Companies are asking to be released from the prohibition, and to be allowed such freedom in fixing a reserve price as may be considered by the Directors fit and proper under the conditions ruling at the time the money is required. Circumstances nowadays change with remarkable rapidity. New factors have come into play which did not affect the steady old-fashioned days, and these factors are all too likely to become with time more intense in their operation.

Better terms have also now to be offered to get people to invest in preferential stocks. High rates of dividend on preference stocks and shares are to-day being offered by well-founded business establishments; and they will have to offer still higher rates in the competitive future. Gas undertakings have long since felt that, where their power in regard to offering preferential dividends was narrowly limited, they stood in the competition for capital a poor chance in obtaining the cheapest possible money by the issue of loan and preferential securities. Here we have the Newcastle Company now asking that, as from the passing of the present Bill, 7 per cent. shall have been deemed to have been inserted in section 15 of their Act of 1901, instead of 4 per cent. in connection with the issue of new preference capital—a raising of the limit by 3 per cent. in fifteen years! What suited 1901 will not suit 1916. The Colchester Gas Company also ask for the right to pay a dividend on their preference stock not exceeding 7 per cent. The Ferndale and Folkestone Companies will be satisfied with "not exceeding 6 per cent.;" while the Fleetwood Company, who as recently as 1912 thought that not exceeding 4 per cent. would suffice for their borrowed money, are now asking for the limit to be raised to 5½ per cent. The Newcastle-upon-Tyne Company want the power to offer 5 per cent. for debenture stock; and the Uxbridge Company are asking for the limit of interest on borrowed money, as inserted in their Order of 1914, to be repealed. Again there is an incipient change in regard to the proportion of borrowing powers to ordinary capital. At one time the borrowing-powers proportion was one-fourth of the total issued and paid-up capital; and then it was raised to one-third. Now companies are leaning to the opinion that it would be an economic procedure to make still larger use of their credit. In the Ascot Act of last year the proportion of borrowing powers was raised to one-half; and now the Newcastle and the Aberdare and Aberaman Companies are also asking for the one-half. But a very favourite movement is the request for powers to issue redeemable debenture and preference stocks. Such desire is noted in the Bills of the South Metropolitan Company, the Imperial Continental Gas Association, the Newcastle-upon-Tyne Company, the Plymouth and Stonehouse Company, the Colchester Company, and the Aberdare and Aberaman Company. All the Bills, of course, provide for the formation of redemption unds.

There are indications here provided by substantial companies that the old terms under which private gas enterprise has been financed in the past are undergoing very definite modification. The terms of the past are out of joint with modern conditions; and, when this is the case, there is only one thing to do, and that is to bring about a correlation between the terms and the conditions.

Co-Operation in Developing Industrial Heating.

IT is generally admitted that, in districts where manufacturing work abounds, the use of gas for industrial heating is going to be a most important branch of the business of gas undertakings; and yet it is a curious reflection that up to now the most spirited work in the development

of the utilization of gas-furnaces and so on has been done not by the suppliers of the fuel for such appliances, but by the manufacturers of the latter. This is to their credit, and undoubted profit. And it is to the profit of the gas-supply industry; but its credit in the matter only extends to the amount of help that has in isolated cases been given to the manufacturers. In some districts this help has been good; in others it has been of quite a passive order. But in all gas-supply areas, the active order of assistance is needed. "The measure of opportunity is the measure of respon-"sibility," said Mr. H. M. Thornton (in another connection) in a lecture he delivered last evening before the Derby Society of Engineers. And in this matter of developing the industrial uses of gas, the measure of every gas engineer's opportunity is the measure of his responsibility; and it is his responsibility to work to the utmost of his opportunity to show the local manufacturers that gas-heating is an important factor in industrial economics. There could be no better time for doing so than the present, when gas heating for the production of war material of all kinds—from shells and machine-guns to small arms, ammunition, and much else—has been so largely adopted and readily applied, and when gas furnaces and crucibles of all types and sizes have been turned out and installed at a rate that has produced a new flood-mark for such work.

What, however, is wanted is a greater amalgamation of brains, and greater co-operative effort, in the work of development. During the war, we have heard a great deal regarding the organization of our national resources—the scientific and the industrial among them. In the gas industry, we have a sample of the organization of part of its resources in the British Commercial Gas Association; but it does not constitute a complete utilization co-operatively of the industry's potentialities. Here we have the manufacturers of gas-furnaces doing their part unaided, except (as already said) in a few cases, in converting manufacturers from crude to scientific heating processes. True, no one is better qualified for doing this, for the development of every detail of the furnaces, and the adaptation of them to all classes of work, have given the manufacturers an unrivalled technical education and experience in the matter, and thus a specialization that cannot be claimed by the suppliers of gas. But the measure of their opportunity is respectively a diverse quantity. Of the accumulated knowledge and experience, the utmost should be made by the gas suppliers through co-operation; and those responsible for the conduct of gas undertakings are in the position to provide the opportunities for making the largest use of it. The lecture delivered last night by Mr. Thornton before the Derby Society of Engineers is a case in point. Mr. J. Ferguson Bell, M.Inst.C.E., the Engineer and Manager of the Derby Gas Company, is this session the Chairman of the Society. What better opportunity could there be for bringing before the engineers engaged in other industries in Derby and the neighbourhood information regarding the vast part that gas is now taking in the nation's work, through the excellent appliances that have been developed in which the thermal value of gas is utilized, and in which, through the regulation of temperatures and conditions, time and working economies are realized? The opportunity was there, and a good platform was available; and we undertake to say that the Derby Society of Engineers have never had before them a lecture, with full and abundant illustration, that was at once more instructive and more to the taste both in the form of subject-matter, and in the manner of treatment. We do not say that, in this, Mr. Thornton excelled what is possible from other manufacturers—indeed, upon the merit of his platform work, in comparison with that of others, it would be invidious for us to pass judgment. With him, as with other manufacturers, it is their business to supply gas-furnaces and to profit thereby; but it is his and their knowledge of the making of gas-furnaces and of the application of them to all sorts and conditions of work that is of value to the gas-supply industry in developing gas-heating in the country's manufactories. And this the lecture last evening (the greater part of which we print in other columns), as have other lectures, shows can be utilized in an informative way without any vulgarizing of the standard of technical association work by constituting the platform provided into a medium for the advertising of an individual firm's wares.

There is an example of co-operative work in the development of the gas industry. It is a co-operation of brains. Among the manufacturers we have some of the finest technicians—specialists in their own departments—in the industry. They want bringing out, more than their own commercial travellers, in the cause of a general industrial expansion. If gas engineers—themselves manufacturers and traders—will stand aloof, and if they will decline to recognize that the spirit of co-operation is abroad, that the organization of talent and resources is to-day one of the primary features of progressive means, then the blame must entirely rest upon their old-fashioned conservatism, exclusiveness, and narrow-mindedness that they are not making the best use, through a common interest, of available opportunities. The manufacturers of gas appliances of all kinds have a large interest in seeing the development of gas supply, just as have the producers of the gas itself. It is through this development that increasing prosperity and stability are brought to the gas-supply industry, and the same to the firms engaged in ministering to the requirements which are the channels of development. If the gas suppliers co-operate in providing opportunities and influential audiences for lectures such as that delivered last evening, and of other order in respect of subject, they will find willing response to the "filling of the bill" by those with the necessary capacity and information at disposal. But these are busy men, and they have their immediate business affairs requiring fairly constant attention. It must not, therefore, be expected that they can spend hours in travelling, and time and money in lecturing to a local debating society, We have used the expression "influen-"tial audiences," which conveys to any intelligent mind exactly what is meant, and what is needed. The Derby Society of Engineers supplied an "influential audience" in relation to the theme of industrial gas heating; a meeting of the members of the medical and architectural professions would constitute an "influential audience" in relation to domestic heating. These are sufficient illustrations. Development from old to new ways needs educational spade work; and impressions left upon the minds of influential audiences are the seeds which germinate, grow, flourish, and are reproductive. There is no limit to the good effect of a well-made impression upon the mind.

To the subject-matter of Mr. Thornton's lecture (which was largely pictured by lantern slides), we will only make passing reference. It was illustrative of many things—of the progress that has been made in gas-furnace construction, in which (the lecturer did not say this, but we may) the Richmond Gas Stove and Meter Company have taken good part; of the manifold applications of gas in the heat treatment of metals; of the need for discrimination in the matter of types of furnaces for particular work; and (this section will be read with especial interest) of the special utilization of such furnaces in the production of war essentials which has changed the whole aspects, operations, and engagements in our engineering and metallurgical industries. It may be said, too, that the war has enlarged the experiences of the manufacturers of gas-furnaces; and this means an expansion of competence in the matter of production and application. Much else was in the composition of the lecture and in the illustrations; and it will all repay perusal. In respect of policy, the occasion has enabled us to make the plea for a greater co-operation in the work of development in the somewhat difficult branch of industrial heating—difficult through long custom and usage, but promising more than ever through the experiences that the war has compelled and has produced.

Gas-Works Experiences in Australia.

HEARTY welcome is given to the New South Wales and Queensland Gas Institute—the newest addition to the roll of professional co-operative organizations in the gas industry. The first annual meeting of the Institute has been held under the presidency of Mr. T. O. Morland, the Manager of the North Shore (Sydney) Gas Company; and the proceedings, as indicated by the address and papers published in this issue, give promise of a healthy career which should be, and must be, of immense service in the technical and commercial development of the industry in the two Colonies. Intercourse of persons concerned in any particular sphere of technical or commercial work is always advantageous; and it is particularly so where, through geographical situation and long distances, there is very little opportunity for coming together for the exchange of experiences and information. The new Institute is the second organization for gas engineers and managers in

Australia; its predecessor being the Victoria Association, of which we have heard little news for a long time now. This silence cannot be due to exhaustion, seeing that Victoria, like New South Wales and Queensland, has been enjoying very good expansion of business, and has had opportunities therethrough for making works' extensions and producing modernization of plant. When this is the trend of things, there is always topic to bring before meetings of gas managers.

In New South Wales and Queensland, the works number only 61, so that there is not much chance of the membership of the Institute swelling to unmanageable proportions. Just as Victoria has a predominating gas undertaking in Melbourne, so New South Wales has the same in the Australian Gaslight Company of Sydney. Nevertheless, the progress in gas consumption during the septennial period ending in 1914 seems to have been quite general in the two Colonies embraced by the new Institute—the increase having been 68·5 per cent. in New South Wales, and 100·3 per cent. in Queensland. But progress of the gas undertakings in them has been not only of the commercial order, but of the technical. The two Colonies are not a whit behind the most advanced part of the world's gas industry in modern types of gas-engineering structure and plant. The Australian Gas Company entered into a contract (we should say) upwards of two years ago for a gasholder ranking equal in capacity to the largest we have in London—viz., 12 million cubic feet. From the President's Address, and from the papers read at the meeting (as reproduced elsewhere), it is seen that vertical retorts, modern stoking machines, material handling plant, and high-pressure gas distribution, are adoptions and recognized practices; and advances will continue to be made in their application. Most undertakings in these Colonies are increasing commercially; and, when this is the case, the opportunities occur and accrue for enlisting the service of the most approved forms of plant and methods. This is being done.

There are two specially interesting points in the President's Address, which may be noticed. At one of the North Shore Company's works, the natural formation of the ground has been brought to bear in facilitating operations on the works. An inclined retort-house is erected at the foot of a cliff, on the top of which—50 feet above ground-floor level—a coal-store has been erected for feeding the inclined retort-house, which is done by subways and shoots running from the coal-store floor, which shoots deliver into trucks, and the trucks into the charging-hoppers. By the aid of the shoots, coal can be drawn daily from all parts of the store, and the temperature of the mass be ascertained. The second point is as to the excellent experience with reversible condensers in reducing naphthalene deposits, and therefore complaints. This experience is a direct outcome of the paper that Mr. Charles Carpenter read in London before the Southern Association in 1901; and this shows how the benefits of the communication of experiences at a meeting of gas engineers and managers are not limited to those present at the meeting itself, but that the publication of the information carries derivable advantage to the uttermost parts of the earth—the Technical Press forming the channel of communication between the meeting and practically every gas engineer and manager in the world.

Excellent experience was recounted by Mr. J. Mackenzie, of Newcastle (N.S.W.), with the Glover-West continuous vertical retorts, which he has had in use for some two and-a-half years; and the experience shows that, as it has done in South Africa and elsewhere, that vertical retort working answers admirably with the local coals. Of course, one cannot say that the continuous system is the best for all classes of coal, especially such types as are not of good coking property. Mr. Philip Holmes Hunt made out a good case some years ago—in 1911 and since—in this connection when he determined on the adoption of the intermittent system for Melbourne. But what Mr. Mackenzie has suffered from has been an excessive swelling of coal in the retorts, or an irregular internal growth of carbon, which has caused "hanging-up" of the charges. But by mixing two classes of coal, he has overcome this trouble, and the working is entirely satisfactory. He, however, questions the validity of the term "continuous" as applied to these retorts, as he finds that, as the extractor removes a quantity of the spent charge, and fresh coal enters the retort, there is a rush of gas; and these intermittent rushes seem to his mind to affect the idea of continuity. This is a small point; but we cannot altogether agree with Mr. Mackenzie with regard to it. The intermittent rush, temporary but not really large, there undoubtedly is. It was a common experience in the days of the old Settle-Padfield retort that as the fresh coal fell into the carbonizing zone, so a large volume of gas was at once evolved; but with the continuous retorts this is minimized. At any time, there are the same temperature and production continuity proceeding at each stage from inlet to outlet of the retort; and this maintains such a uniformity in gas composition that we have those excellent straight-line calorific value charts, such as Mr. J. G. Newbigging has more than once presented to the gas profession. While Mr. Mackenzie has nothing but good to say of the continuously working retorts from the economic aspect, he does point out that the coke is harder and contains less volatile matter than coke from horizontal working, and that the tar is thinner and contains more light oils. What are advantages in this country thus appear to be disadvantages in Australia. Here a hard coke realizes more money for metallurgical, greenhouse, forge purposes, &c.; but Mr. Mackenzie's market seems almost exclusively the domestic one. Here a tar containing an increased quantity of light oils appreciates in value. Evidently Australia hitherto—it cannot be so now—has not had a large market for light oils, seeing that the author of the paper appears to make it almost a point for complaint that, before the vertical retort tar is suitable for road-making purposes, it has to be denuded of its water and light oils. All the better for the roads, even in comparison with crude tar from horizontal working. Tar is in very good demand in Australia for road purposes; its use being recognized there as an economy through the improvement in the cost of road maintenance. The heat so dries the roads that the surfaces of macadamized ones get broken up by the traffic; and it has been found that nothing keeps them in such good condition as a few coats of hot coal tar. When these have been applied, it is the experience that the hotter the weather the more elastic the road becomes.

Of no less interest is the paper by Mr. T. F. Waugh, on "High-Pressure Distribution." From this it is seen that the Australian Gas Company have gone in for high-pressure work extensively for increasing and maintaining the supply of gas in the suburbs. At the present time, they have no less than 160 miles of high-pressure gas-mains, with ninety district governors working off them. The system is found to be financially economical, and an unqualified success in operation—the consumers in the most remote quarters now obtaining an unvarying supply, irrespective of demand. There is one point Mr. Waugh especially emphasizes, and it is that money spent on testing high-pressure mains is money well spent.

We congratulate the new Institute on the character of their inaugural proceedings, and wish the organization a continuously cumulative success.

Coal Figures.

Information regarding a number of matters of interest in connection with the much-discussed subject of coal is to be found in Part III. of the Home Office Annual Report on Mines and Quarries for 1914, figures extracted from which, along with some taken from previous issues of the Blue-Book, are reproduced on another page of this issue. Furnished on much the same lines (though in a very abbreviated—war economy—form) as hitherto, the statistics offer ample scope for comparison with other recent years. In the first place, it will be noted that the record output of coal in the United Kingdom that was experienced in 1913 was not beaten in 1914, which, on the contrary, shows a falling off of 21¾ million tons, with a total of 265¼ million tons. At the same time, the value was less by practically £13,000,000. As a matter of fact, the total value of the minerals raised during 1914 in the United Kingdom amounted to £145,863,032, of which coal accounted for £132,596,853; the decrease being £14,249,635, as compared with 1913. Along with the falling off in the output of coal, there is witnessed a slight decrease—something less than 2d. per ton—in the average price realized at the pit's mouth; the figure being 9s. 11·79d., as compared with 10s. 1·52d. for the year before. Though the general figures for 1914 and 1913 are of more general concern, few persons who study this Blue-Book will be able to pass over, without some reflections on their magnitude, the total figures quoted, as indicating the wealth which the country is deriving from its mineral resources. During the forty-two years from 1873 to 1914, we are

told, the value of the minerals raised amounts to £3,664,980,074; and of this sum coal accounts for £3,083,191,238, or 84·1 per cent. In that period, 8,206,243,000 tons of coal have been raised, of which amount 2,012,796,000 tons, or more than 24½ per cent. of the total production, have been shipped abroad as exports, in the form of coal, coke, and manufactured fuel, and as coal used in steamers engaged in foreign trade. The percentage of coal so shipped abroad rose steadily from time to time, until in 1913 it amounted to 34·2 per cent., as compared with 13·8 per cent. in each of the five years from 1873 to 1877. For 1914, however, there is exhibited a decline to 30·5 per cent.

An Engineering Correspondent and Train Lighting.

The writer of "Engineering Notes" in the "Daily Telegraph" has been stating his views in condemnation of gas lighting on trains and in favour of electricity. We do not know what this gentleman's qualifications are for passing judgment; but he appears to have based it on the assumptions which have been found in the reports of Board of Trade Inspectors, without any definite evidence to support them, and with the conditions all against them regarding what happens on gas escaping at high pressure from fractured gas-cylinders. It is very evident that the writer of "Engineering Notes" in the "Daily Telegraph" knows of the subject just about as much as—perhaps less than—the Board of Trade Inspectors, on whose reports he depends, and with which reports he seems to have a very poor acquaintance. He says that the recent Tyneside disaster furnishes another tragic reminder of the danger of using gas for the purposes of lighting railway carriages. We should like him to point to something definite in the evidence in support of this statement. There were certain people who "thought" the flames they saw were caused by gas. But when technical evidence is given as to cylinders being fractured and burst, and connections wrenched off them, it would be interesting if this engineering correspondent would tell us how, under such conditions, high-pressure gas let loose, would hang about the railway carriages for the purpose of contributing to the conflagration. "Unfortunately," he also says, "we have had accident after accident in recent years on our railways where the wreckage has been fired . . . by escaping gas." Where is definite evidence of this? He also wants members of Parliament to insist on Government action; "otherwise we shall assuredly have many repetitions of the horror of Jarrow and Aisgill—to mention but two names in a long and ghastly list." This is proof positive that the writer does not know anything very exact about the matter of which he is writing.

From the Inspectors' Reports.

We look back. Major Pringle, in his report on the Hawes Junction disaster said: "This is actually the first occasion when it can be proved beyond question or doubt that fire was occasioned by burning gas. It has to be remembered also that gas has been in use for lighting purposes for a very long period, and that during the whole of that time—in fact, since the year 1868—there is no case of fire destroying either the lives or bodies of passengers in railway accidents." In his report on the Ditton Junction disaster, Lieut.-Col. Yorke said, in fairness to the London and North-Western Railway Company, that gas had been in use upon their trains for thirty years, during which period 2937 million passengers had been carried; and this was the first occasion on which it had been suggested that gas had been concerned in burning one of the Company's trains. However, in this Ditton accident, the Inspector assumed that, though the pipes and connections were all broken off the cylinders, and gas at high pressure was thus liberated to the open air, gas had something to do with promoting the conflagration. As we showed in an article in the "JOURNAL" for Dec. 31, 1912, there was never a case presented in which pure conjecture predominated more than in the Ditton one as to the part that gas had taken. In the case of the Aisgill accident (on which the "Engineering Correspondent" so much relies) Major Pringle pointed out that the gas must have promptly escaped, in view of the condition in which the cylinders were found; and he concluded that the more serious outbreak of fire arose not so much from the ignition of gas (which he only thought caused the first visible appearance of fire), but from the contents of the ash-pan and the heat radiated from the engine. Then, again, in the Carlisle accident, Lieut.-Col. Druitt stated that he considered the cause of the outbreak in the main part of the wreckage was due to live coals from the overturned engines of the troop train, though he was of opinion that the fire was afterwards intensified by the escape of gas from the cylinders as they burst. It is more likely that the cylinders did not burst at all, but that they were broken, and had their connections severed immediately in the accident, under which conditions there would be no after-bursts. Lieut.-Col. Druitt added that he considered a fire would have occurred even if all the vehicles had been electrically lighted. In view of these statements, in view of the obvious conditions that must obtain with fractured cylinders or severed connections, it would be interesting to have from "Engineering Correspondent" a technical explanation as to his attitude.

The Waggon Pooling Question.

The legal position in relation to privately owned railway waggons has been stated in an interesting article that has appeared in the "Iron and Coal Trades Review," and, in our "Miscellaneous News," we have, under acknowledgment, reproduced the greater part of the article. In another article, our contemporary, by the process of deduction, seems to have arrived at the conclusion that there is a good chance of the last having been heard of the pooling arrangement, so far as private trucks are concerned. The project, it says, has either been abandoned altogether, or postponed for further consideration at a more convenient time. The "further consideration" was promised directly the storm of protest came about the Board of Trade; but, as to the abandonment, we do not think the ground of inference adopted by our contemporary is a sufficient one. It says: "It seems all the more probable that no attempt is to be made to interfere with the private rolling stock, because there was no reference at all to the matter when questions relating to the supply of waggons were asked in the House of Commons just before Christmas." If there is not anything stronger than this to go upon, then there is not much there to support the idea of abandonment. We think a much more hopeful sign is that the remonstrances of the private owners had such immediate effect in persuading the Board of Trade that there was another side to the scheme that in justice demanded consideration. The postponement, and the fact that nothing more has yet been heard of the matter from official quarters, suggest that the difficulties surrounding the proposal are found sufficiently serious to justify the matter being entirely dropped. However, the "Review" states that it is thought some pooling scheme will be applied to all railway owned trucks.

Coming Patent Changes.

A change is coming about in connection with the numbering of patent specifications, which is intended to have for at any rate one of its main objects the earlier publication of abridgments of specifications in the "Official Journal" of the Patent Office, so as to facilitate search. The intimation which is being made by the Comptroller-General (Mr. W. Temple Franks) is to the effect that, in order to give the public the advantage of having abridgments of specifications up to date, while retaining their numerical sequence, applications for patents made after the end of last year will be given new numbers when their complete specifications are accepted, or become open to public inspection before acceptance. In connection with the new numbers, there will be no mention of a date; and, doubtless in order to avoid any possibility of confusion, a start will be made at No. 100,001. This new number will supersede the original application number in all respects after the acceptance of the complete specification. Up to this time, the original application number should be used for correspondence and similar purposes; but in all proceedings after acceptance the new number only should be employed. For the future, too, reference to the "Official Journal" will be simplified by the fact that applications will be arranged alphabetically under the names of the applicants and communicators, instead of numerically as at present. The application number will be followed by the date on which the application was filed. The date, however, which the patent will bear, if granted, will appear in a subsequent list of complete specifications accepted. As the result of the new arrangements, it is intended to publish abridgments of specifications in the "Official Journal" a few weeks later than the number in which their acceptance or publication is advertised, so that they will be available for search purposes soon after the printed copies of the specifications are on sale; but until the system is fully in force, they will only be issued when there are sufficient to

make up a full sheet of sixteen pages. Until April of next year, the present series of abridgments in the "Official Journal" will run concurrently with the new series; but as from that time, it will be entirely superseded.

Board of Trade Arbitration.

The present policy of appealing to the Board of Trade for an arbitrator in connection with industrial disputes [of which instances are from time to time to be found in the pages of the "JOURNAL," as elsewhere], is not regarded with favour by the Executive Committee of the Employers' Parliamentary Association, who express the opinion that it is wrong. There is no doubt, in many instances, a great deal of truth in the argument which is put forward by them in the annual report of the Association, that the cause of industrial unrest is largely ignorance—on the part of the workers as to the difficulties of employers, and on the part of employers as to the conditions under which the workers live. Taking this as their standpoint, it follows that the Committee prescribe the principle of joint conference as the most practicable remedy; so that, by educating one another, both sides can see matters in a right perspective. There is cited as strongly endorsing this view the freedom from disturbance which characterizes industries where both employers and employed, efficiently organized, can confer frequently. Can there be, one wonders, any better method than co-partnership for securing the close relationship which is here implied? So far from this desirable condition of affairs being promoted by Board of Trade arbitrations, the Committee say the result is that each side views the other with antagonism, and the cleavage of interests becomes even more pronounced. There is, however, another aspect of these arbitrations to which attention is drawn in the report—the Committee are, of course, dealing with the Board of Trade industrial arbitrations, and not with proceedings of any other kind. It is claimed by them that a study of the results of labour disputes would indicate that the arbitrator, in a very large proportion of cases, "simply divides the demand for an increase in wages by two." That is to say, if a demand is put forward for an increase of 6d. per hour, both sides in many instances are aware that an increase of 3d. will be granted. It is to be hoped that the Committee are mistaken in their conclusion as to the manner in which these decisions are, "in a very large proportion of cases," arrived at; for it cannot be denied that, as they say, to reduce a question of national importance to the level of a division sum is playing with the problem, and tends to increase the difficulty. They would, if they had their way, discourage parliamentary or departmental interference with the relationship between capital and labour; and they declare themselves in strong opposition to the policy of compulsory arbitration.

PERSONAL.

The North Berwick Town Council have appointed Mr. R. J. PHILP as Manager of their gas-works, to succeed Mr. R. B. Chalmers, who, after 2½ years' service, is leaving to take up a position with Messrs. R. & A. Main. Mr. Philp is at present Gas Manager at Polmont.

The duties of Manager and Secretary of the Cirencester Gas Company, Limited, which were previously combined, have now been separated. Mr. E. M. BEECHAM retains the managership; Mr. E. J. WALLIS has been appointed Secretary, after having acted as Assistant Secretary for close upon four years.

The position of Engineer to the Gosport Gas Company has been filled by the appointment of Mr. EDWIN ALLISON, Assistant Engineer at Redhill. He served articles to Mr. J. C. Belton, at Chester, and afterwards joined the drawing office staff of Messrs. George Waller and Son, of Stroud. In 1910, Mr. Allison obtained a position on the managerial staff of the Londonderry Gas Company, which he vacated in 1911, upon being appointed Assistant Manager at Airdrie. He was appointed to Redhill two years ago.

Professor Meldola, who died on Oct. 16, left property of the value of £34,956; the net personalty being £33,767.

The "Beal Medal" has been awarded by the Committee of the American Gas Institute to Mr. Frank W. Steere, of Detroit, Mich., for his paper on "An Electrical Process for Detarring Gas"—regarded by them as the best paper presented at the annual meeting of 1914.

Gratification has been occasioned at Ilkeston by the fact that the Mayor (Mr. J. A. Macdonald), who has accomplished excellent work as Chairman of the Corporation Gas Committee, has been selected, upon the nomination of the Lord Lieutenant (the Duke of Devonshire, K.G.), as a Magistrate of Derbyshire.

GAS BILLS FOR 1916.

[SECOND ARTICLE.]

CONTINUING our review of the Gas Bills which have been lodged for the consideration of Parliament in the coming session,

The next measure to be noted is that of the Folkestone Gas and Coke Company. The preamble recites among other things, that the present capital consists of £45,000 of 10 per cent. shares (including converted loan capital raised under the Act of 1865, £60,000 of 7 per cent. shares, £15,000 of 5 per cent. shares (being converted loan capital raised under the Act of 1876), and £50,000 of 7 per cent. shares. The Company are proposing to absorb the Hythe and Sandgate Gas Company, whose capital consists of £6660 in ordinary shares, entitled to a standard dividend of 10 per cent. per annum, £12,900 in ordinary shares entitled to a standard dividend of 7 per cent. per annum, £1060 of 4 per cent. preference shares, £3380 of 5 per cent. preference shares, and £10,140 of 6 per cent. preference shares, leaving additional capital to the amount of £4860 authorized to be raised under the Hythe Order of 1911. The Hythe Company have also raised on loan the sum of £8800 by the issue of £8800 of 5 per cent. debenture stock, leaving a further sum of £2200 to be raised under the Order of 1911. Between the two Companies, considerable confusion, it is stated, has arisen as to their respective limits of supply in Cheriton and Sandgate in which the distribution mains overlap. The Folkestone Company have for some time past supplied part of Cheriton which is within the limits of supply of the Hythe Company; and the Hythe Company have also for some time past supplied part of the borough of Folkestone which is within the limits of supply of the Folkestone Company, and beyond the limits of the Hythe Company. An action is now pending by the Hythe Company against the Folkestone Company in connection with the supply to Cheriton. Under these circumstances it is as well that differences should be finally composed by fusion. It is also desired to enter into agreements for the transfer of the undertaking authorized by the Elham Valley Gas Order of 1912. Turning to the clauses of the Bill, it is seen that it is proposed to issue to the holders of ordinary or preference shares of the Hythe Company ordinary stock of the Folkestone Company. Holders of £10 nominal value of Hythe stock entitled to a standard dividend of 10 per cent. will receive £10 of the Folkestone ordinary stock; holders of £10 nominal value of the Hythe ordinary stock entitled to a dividend of 7 per cent. will receive £7 of Folkestone ordinary stock; holders of preference shares of £10 nominal value of the Hythe Company entitled to a dividend of 4 per cent. will receive £8 of ordinary stock; holders of £10 of Hythe preference shares entitled to a dividend of 5 per cent. will receive £10 of ordinary stock; holders of £10 of Hythe preference shares entitled to a dividend of 6 per cent. will receive £12 of ordinary stock. In addition, the Folkestone Company are to issue to each of the five Hythe Directors £210 of ordinary stock, and to Mr. H. Stanier, the Secretary of the Hythe Company, £500 of ordinary stock. To the holders of Hythe debenture stock, each £100 is to be entitled to £125 of 4 per cent. Folkestone debenture stock. Power is asked to create the necessary stock for the purpose of the absorption; and provision is made for the payment of the Hythe dividends up to June next. Provision is to be made for the conversion of the existing Folkestone share capital into one class of 5 per cent. stock, to be called ordinary stock; and it will be vested in the holders of shares as follows: For every £10 share entitling the holder to a dividend of 10 per cent., £20 of ordinary stock; for every £10 share entitling the holder to a dividend of 7 per cent., £14 of ordinary stock; and for every £10 share entitling the holder to a dividend of 5 per cent., £10 of ordinary stock. It is also provided that the powers conferred upon the Company by the Act of 1898 of raising further capital by shares or stock (so far as they have not been exercised) shall continue in force, and be exercisable up to July 1 next, by the issue of further amounts of shares entitling the holders to a dividend of 7 per cent., and on and after that date by the creation and issue of ordinary or preference stock. Dividends on the preference stock are not to exceed 6 per cent. per annum. In respect of the ordinary stock created for the transfer of the Hythe Company, and the ordinary shares of the Folkestone Company existing on June 30 next, the Company ask for power to borrow (including the amounts already borrowed) the sum of £77,000; and in respect of the additional capital the equivalent of one-third part. It is proposed that the Treasury clause as to the issue of capital during the war and for twelve months after, shall not apply to the stock required for the satisfaction of the Hythe shareholders's claims, nor as to the converted share capital. The proposed extension of limits of supply is defined, and here is where the Company seek to acquire the undertaking authorized by the Elham Valley Gas Order. The standard price of gas is proposed at 3s. 6d., with the sliding-scale operating half-yearly. In connection with the price of gas, the Company appear to have divided their district into three parts—the inner, the middle, and the outer areas. In the middle area, the price is not to exceed by more than 6d. the price charged in the inner area, and the price charged in the outer area is not to exceed that charged in the middle area by more than 6d. Differential prices are arranged for, with protection of consumers against preferential charges. A calorific value standard is to be substituted for the illuminating power standard; and it is

proposed that the calorimeter shall be "agreed upon between the Company and the Corporation (or, failing agreement, to be approved by the Board of Trade), which shall be so constructed as to be capable of yielding the total heat value expressed in British thermal units of the gas supplied by the Company." The standard desired is a level 500 B.Th.U. Other clauses are of ordinary form. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Hornsey Gas Company are promoting a Bill with two main purposes—to define the boundary between the respective limits for their area of gas supply and that of the Gas Light and Coke Company, and to authorize the manufacture of residual products on a certain portion of the existing works. The principal clauses relating to the adjustment of boundaries are as follows:

> From and after the passing of this Act, the Company shall have the exclusive right to supply gas within the portion of the limits of supply of the Company comprising the parish of Hornsey, except in such parts thereof as are excepted from the limits of supply of the Company by section 4 of the Act of 1866, and the Hornsey Gas Acts and Orders, 1866 to 1916, shall apply accordingly: Provided always that, until the completion of the sale and purchase referred to in the section of this Act of which the marginal note is "Purchase of Certain Works of Gas Light Company," nothing contained in this section shall be deemed to prevent the Gas Light Company continuing to afford any supply of gas which they are affording at the date of the passing of this Act within any part of the said parish which is within the limits of the supply of the Company.
>
> From and after the passing of this Act, the part of the parish of Hornsey first excepted from the limits of supply of the Company by the said section 4 of the Act of 1866 shall be deemed to be part of the limits of supply of the Gas Light Company.
>
> Upon the passing of this Act, the Gas Light Company shall forthwith sell, and the Company shall forthwith purchase, all mains, pipes, and other works of the Gas Light Company within that portion of the parish of Hornsey in respect of which exclusive rights to supply gas are by this Act conferred on the Company.
>
> The consideration for such sale and purchase shall be such sum as may be agreed between the Company and the Gas Light Company, or as, failing such agreement, may be determined in accordance with the provisions of the Arbitration Act, 1889, by an arbitrator agreed upon between them, or failing such agreement, appointed by the President of the Institution of Civil Engineers, upon the application of either of the said Companies.

Provision is made as to the payment by the Company of the consideration due to the Gas Light and Coke Company, and for the preparation of maps showing the limits of supply of the two Companies so far as they are connected. The lands are scheduled on which the Company desire authorization to "work up, manufacture, and convert the residual products arising directly or indirectly from the manufacture of gas." Power is taken to form a special purposes fund and a benefit fund—the latter by the appropriation out of revenue as part of the expenditure on revenue account of any sum not exceeding ½d. per 1000 cubic feet of gas supplied during the year. But the sum so appropriated, and for the time being standing to the credit of the benefit fund, is not at any time to exceed the amount which the Directors would have been entitled to appropriate to the fund out of the revenue at the prescribed rate during the then preceding five years. A novel clause gives the Company power to apply to the general purposes of the undertaking to which capital is properly applicable the sum of £25,000, being part of money now in hand on revenue account. The money thus appropriated, it is proposed, shall form a separate class of capital, to be known as "B" capital, and is not to be treated as part of the capital entitled to dividend. There are a number of miscellaneous clauses included in the measure; but they are all more or less of general adoption in modern legislation. One that is not of general adoption, but is not novel, empowers the Directors to grant gratuities, or make such pension or other allowance or payment as they may think fit to any employee disabled, injured, or incapacitated while serving with His Majesty's forces, or, in the event of any employee being killed in action or dying of wounds, injury, or disease received or contracted while in such service, to the dependent of such employee. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Bill which is being promoted by the Imperial Continental Gas Association is to confer additional powers, to confirm the distribution of funds among the proprietors, to authorize the issue of stock at a discount, to enable the redemption of debenture stock, to permit of the holding of one meeting instead of two in a year, and to make new provisions as to the directorate. The clauses were sufficiently described in our issue for Dec. 28, p. 712. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Newcastle-upon-Tyne and Gateshead Gas Company are in Parliament for an extension of their limits of supply, for powers to construct new works, and to obtain further authority in connection with their authorized capital, in respect of which it is submitted that: "Having regard to the present state of public affairs, it would be to the advantage of the Company and the consumers of gas within the limits of supply of the Company, and would facilitate the raising by the Company on economical terms of the moneys required for the purposes of their undertaking, that the Company should be empowered to raise further moneys by the creation and issue of debenture stock." The preamble of the Bill gives some interesting information concerning the capital. The nominal amount created and issued (including the nominal amount added to the capital consequent upon the consolidation and conversion under the Company's Acts of 1873 and 1901 respectively of the ordinary and preference stocks) is: 4 per cent. preference stock, 1896, £110,166; 4 per cent. preference stock, 1901, £140,000; ordinary stock, £1,875,892—total, £2,126,058. As premiums on the sale of stock, £379,106, has been received. The amount of money received by the creation and issue of stock, including the premiums, is £1,677,594. The Company are authorized to raise a further £378,383 by the creation and issue of new ordinary stock or new preference stock. They have raised by the issue of 3½ per cent. debenture stock £529,705, and they have received by premiums on the sale of this stock £10,819. By their Acts the Company are authorized to raise a further £159,800 by the creation and issue of debenture stock. In order to meet the increasing requirements of the consumers of gas within the existing limits of supply, as well as to provide for a supply of gas within the extension of these limits, the Company will require to raise additional money by the creation of further amounts of their authorized capital; and so they make the submission already quoted regarding the debenture stock. Among the first clauses are those which deal with the extension of the limits of supply; and the parishes, urban districts, and townships in the counties of Northumberland and Durham that are included make a goodly list. It is, however, provided that the Company shall not at any time supply gas beyond the existing limits of supply if such supply would interfere with the sufficiency or efficiency of the supply within the City of Newcastle-on-Tyne and the County Borough of Gateshead. Lands are described in the schedule on which the Company may erect and maintain gas-works, and work up and convert residual products arising directly or indirectly from the manufacture of gas. The Company also include what are practically the model provisions as to the purchase of residual products from other gas undertakings; but, of course, without the one-third restriction. In the succeeding clauses, they are arranging to cease to supply gas on an illuminating power standard as from the end of this year; and for the setting-up of a level 500 B.Th.U. standard, to be tested under the prescriptions of the Metropolitan Gas Referees—the apparatus to be that which is "the most suitable for ascertaining, and shall be used in such manner, and under such conditions as to ascertain, after any necessary calculations have been made, the total heat value of the gas." Power is given to the Board of Trade to alter the calorific standard at triennial intervals, at the instance of the Company or the Corporation of Newcastle, or the Corporation of Gateshead, if satisfied that such variation should be made. Differential prices are provided for; but the Company are not to give "any preferential price as between any consumers who shall take a supply of gas for similar purposes, in similar quantities, and under similar conditions and circumstances." This clause it is proposed shall be retrospective. Succeeding are provisions as to the creation and issue of debenture stock, to bear interest at a rate not exceeding 5 per cent. per annum, "provided that the amount to be from time to time raised by the Company by debenture stock, including the amount raised by the creation and issue of debenture stock prior to the passing of this Act, shall not exceed one-half of the amount for the time being raised by the Company by the creation and issue of ordinary and preference stock." Any debenture stock created by the Company, but not issued before the passing of the present measure, "shall, notwithstanding anything contained in section 17 of the Act of 1901, or in the resolution creating such stock, bear interest at such rate not exceeding 5 per cent. per annum as shall be prescribed by resolution of the Company in general meeting." Then the repeal of so much of section 19 of the Company's Act of 1901 is asked for as provides that the reserve price put upon stock for sale by auction or tender shall not be less than the nominal amount thereof; and it is now asked that it shall be lawful for the Company, "for the purpose of any such sale by auction or tender of any such stock, to fix such reserve price as they may think fit." Another important financial provision has reference to the dividend on new preference capital. It is provided that "seven pounds" shall be deemed to have been inserted in section 15 of the Act of 1901 instead of the words "four pounds." Of course, the change will only apply to preference stock issued after the passing of the present measure. The Company also require power to create and issue as redeemable preference stock any preference stock "which they are by the Act of 1901 authorized to create and issue, and which has not been created before the passing of this Act, and the resolution creating such redeemable stock shall specify the terms and conditions on which such stock shall be redeemed." The Company take power to issue as redeemable debenture stock any debenture stock which they are, by virtue of this measure, authorized to create and issue, and also any debenture stock previously authorized but not issued. Provision is also made for the formation of a redemption fund. Included is the Treasury clause restricting the raising of money without their consent during the war and for twelve months after. [*Parliamentary Agents: Messrs. Dyson and Co.*]

In pursuance of the purchase clause inserted in the Northwich Gas Company's Act of last year, the District Council are promoting a Bill to empower the transfer. In connection with the money powers, estimates have been prepared showing that the requirements of the Council are: For the erection, extension, alteration, and improvement of the gas-works, £17,000; for new gas-mains and the extension and improvement of mains, £9000; for new services, meters, stoves, and fittings, £6000. Notice to purchase

the undertaking is to be given to the Company within six months after the passing of the Act; the purchase is to be by agreement or, failing agreement, by arbitration. The Council are to pay, in addition, the costs of the Company's Act of last year, and for watching or procuring any amendment of this Bill, together with £200 in respect of the transfer of the undertaking and the winding-up of the Company. Compensation to the directors, officers, and others is provided for. The Council are to pay the purchase money on a date to be agreed upon, or on the expiration of three months from the date of the award, unless the Treasury refuse their consent to the borrowing of the money. In this event, the Company are not to be entitled to require the Council to pay the purchase money until one month after such consent is given, or the necessity for such consent ceases, whichever is the earlier. It is further provided that, if the Council do not pay the purchase money on the date of transfer, they shall pay interest thereon at the rate of 5 per cent. per annum from the date of transfer until the date of actual payment. The limits of supply are defined; and all necessary powers taken to construct and maintain gas-works. The model residuals clause (*minus* the one-third restriction) appears. A calorific value clause, setting up a standard of 500 B.Th.U., tested in the manner prescribed by the Metropolitan Gas Referees, is inserted. The fittings clause is on the model lines, providing for this branch of the business being conducted in such a manner that there shall be no loss upon it. As to financial powers, the Company seek authority to borrow the requisite amounts for the purchase of the undertaking and incidental thereto, with a repayment period of forty years; the sum necessary for discharging any debentures, mortgages, obligations, and liabilities subject to which the undertaking is transferred to the Council, with a repayment period of forty years; £17,000 for works, also with a repayment period of forty years; £9000 for new mains and extensions to, and improvements of, the distribution system, with a repayment period of thirty years; and £6000 for new services, meters, stoves, and fittings, with a repayment period of fifteen years. [*Parliamentary Agents: Messrs. Butterworth and Co.*]

ELECTRICITY SUPPLY MEMORANDA.

Lapsus Memoriæ.

The President of the Board of Trade recently remarked in Parliament that, "so far as commerce is concerned, Germany is a beaten nation; and it is our business to take good care that she does not get her head up again to the same extent after the war." Following this consoling statement, Mr. Runciman said it would be the special business of the Board of Trade to foster industry after the war, which is a highly gratifying prospect if the Board of Trade—forsooth! precedent does not give ground for great hope—is capable of such beneficent and much needed work. "Meteor" of the "Electrical Times" has his doubts. He cannot find anything in the origin, nature, and traditions of the Board to encourage hope. The effects of the Board's activities on electrical enterprise have been, according to this observer and critic, particularly blighting. He depreciates the industry. His moody condition after Christmas leads him to describe the industry as still youthful and struggling (at 33 years of statutory life!), and without powerful friends; and, under the circumstances, it has had to suffer impositions which gas would have sturdily flung aside. "The public is scrupulously protected against electricity at any cost, whereas gas may poison, maim, and burn without injury." Spotless and impeccable electrical industry! "Meteor" has forgotten all about poisonous and explosive gases having been generated by the heating of the insulation of fused cables; he has quite overlooked the awful list of fatalities electrically produced in factories, workshops, and elsewhere; electrical troubles in coal mines, which have killed and maimed, have escaped his memory; and fled from knowledge are the gruesome happenings on subterranean electric railways. The record of maimings and burnings due to electricity would fill a whole number of the "Electrical Times." But "Meteor" only remembers that gas has been a guilty party in such matters. Forgetfulness, or more likely narrow-mindedness, could not have better illustration.

Thermostatic Control in Room Heating.

Mr. George Wilkinson, of Harrogate, is advocating thermostatic control in room heating, and a considerable addition to installation expenses. We fancy in this matter he is as one crying in the wilderness, and that he will have few electrical followers, who already find that installation expenses and running costs are quite sufficient under ordinary circumstances to argue upon in trying to secure the adoption of electric heating, without having to add 55s. per room by introducing thermostatic control, as well as the extra expense of maintenance that it must involve. He assumes that a rating of 1½ watts per cubic foot of room space is sufficient for the coldest day, which it is not. Other experts consider 2 watts a necessary average; and the correct figure, whatever it may be, depends upon the conditions of the room itself. However, assuming that 1½, 2, or any other number of watts per cubic foot are correct for the coldest day, this would be a wasteful continuous consumption for every other day of the year. He maintains that the provision of one or two switches does not in any case furnish the required control—first, because such switches are seldom used, and are not used at the right time, and for the correct period; and, secondly, because the external temperature and the weather conditions are constantly varying at irregular intervals, so that no simple combination of hand-operated switches can meet the case, or prevent considerable waste of current. Therefore, in his opinion, the only economical and effective way of dealing with the heating problem is by means of thermostatic control. Different people have different ideas as to what is a comfortable temperature; and most people would object to living in a fixed temperature at all times, and in all weathers, and would prefer to obtain regulation, according to their own current feelings and requirements, by a tap in the case of gas-fires or by switches in the case of electric "fires." However, Mr. Wilkinson has devised a mercurial thermostat, which he finds answers admirably—not only with electric radiators, but with—man of catholic tastes that he is!—a gas-fire of modern type in his study. In his case, he secures a working economy in the use of the thermostat, and personal relief from the obligation of adjusting the fires to the requisite temperature. Thermostatic control has long been applied to water-heating devices in which gas is used; but we are doubtful as to any large demand for a device that would cost 55s. in every room in which a gas or electric heater is installed.

Lighting of Artizan Dwellings.

The review made last week of matters associated with the work of the electrical industry during the past year, postponed notice of a brief—and it is a very brief—reply in the "Electrician," to our comments on the article by Mr. J. Cleary, describing an experience at Brighton in the lighting of artizan dwellings. [See "Memoranda" for Dec. 14, p. 579.] The "reply" does not touch several of the points raised in our criticism, and particularly the one affecting costs—in fact, it avoids completely the most essential questions. The subject of decoration is touched upon—lightly. We are told that the cost of decoration is one that falls upon the Corporation Health Committee, and not upon the Electricity Committee; and therefore "presumably" the Health Committee are able to determine the cost. As we previously pointed out, the Health Committee are not the only people in the world who have had experience of the needs, from the points of view of cleanliness and sanitation, of redecoration in artizan dwellings; and even now our friends do not tell us whether the condemnation of gas was based upon flat-flame lighting or the use of proper incandescent lighting units. With bijou and medium lights, our ceilings in the suburbs of London go for years without the scorching due to the employment of larger sized units, or the blackening due to incomplete combustion with flat-flame burners. It is pointed out that in the low-pitched rooms of artizan dwellings, the light cannot be placed so far away from the ceilings as in houses of a better class; and if they are situated low down, the lighting is unpleasant from the point of view of glare. Our contemporary should avoid remarks which bring into comparison the, for similar candle powers, large area source of light provided by a mantle with the small area source of light provided by an electric-lamp filament. On the financial side of the question, which the "reply" evades in every particular save that of lamps, it is stated that the cost, except for meters and lamps, falls on the Health Committee, and that the charge to the Electricity Department for a new lamp is not 2s. 8d., but 1s. 7d. What does this mean? Is it that the charges in connection with the costs of the installation, excepting meters and lamps, are borne by the Health Committee, and are not chargeable upon the average income of 26s. per annum per house? If so, then how does this Brighton experience bear generally upon lighting in artizans' dwellings where there is no benevolent Health Committee to carry the cost of installation, but the electricity purveyors have to meet it, and yet make a profit on the small total revenue? Now it appears that the lamps are not 40-watt ones, but are of 50-candle power. This makes the consumption per lamp per hour upwards of 60 watts; so that, in the construction of a balance-sheet, the 60 watts would be worse for the "profit" realized than with lamps using 40 watts. On the question of glare, it is remarked that no great cost is involved in the frosting of lamps, so as to hide the filament from view, and thus avoid eye strain; and "it is understood that [at Brighton] much attention is given to suitable shades." Our contemporary's statement is evasive. It does not say whether or not the lamps are frosted that are used at Brighton; and as for shades, Mr. Cleary does not say in his original article that *all* the lamps were fitted with shades. The "Electrician" should refresh its memory on the point. However, if the lamps are frosted, they do not give an illuminating power of 50 candles—the frosting greatly depreciates the light. According to whether the frosting is light or heavy, the depreciation may be from 10 to 30 per cent.

The Percentage Wired.

An investigation has been made in Melbourne, which has shown that only 25 per cent. of the buildings are wired for electric lighting. The position is worse in London. In the volume of "Comparative Municipal Statistics, 1912-13," issued by the London County Council, it was shown that the number of electricity consumers in London is 143,980, compared with 1,223,995 gas consumers—and this difference without taking into account consumers who use other lighting agents. In view of the low percentage of premises wired in Melbourne, the City Electrical Engineer has been instructed to report upon a system of wiring

by which the cost will be repaid by the consumers in monthly instalments. Objections have been raised to the scheme on the ground that companies who have embarked on schemes of assisted wiring have almost in all cases been unsuccessful with them, and, secondly, that they involve competition by the Corporation with wiring contractors.

Trade Teachings in School Questions.

A correspondent tells us that at one of the branches of Clark's Colleges, Limited, he came across a question in which he thought we should be interested, and those who were guilty of the folly of putting the question might be corrected. In effect, if not in actual words, this was the proposition and inquiry put before the student for consideration and answer: "For house lighting in a certain town, gas costs 3s. 5d. per 1000 cubic feet, and electricity 4d. per unit; and eight units of electricity give as much light as 1000 cubic feet of gas. Which is cheaper to light a house with if the same amount of light is provided in either case? And what difference is there between the two systems for a house that would use 77,000 cubic feet of gas?" In the first place the "facts" on which the question is founded are not correct. In normal times, the major part of the gas consumed in the United Kingdom is sold—in London and the large provincial centres—at 2s. 6d. and below per 1000 cubic feet; and we do not know of any town where gas is sold at 3s. 5d. per 1000 cubic feet where the price of electricity is as low as 4d. per unit. Even in London 5d. and 5½d. are not unknown prices for lighting purposes. Then the statement that eight units of electricity give as much light as 1000 cubic feet of gas is incapable of photometrical substantiation. Using metallic filament lamps, the utmost illumination that can be secured from a unit of electricity is 800 candle-hours; while the modern recognized types of inverted incandescent gas-burners will easily return 20 candles per cubic foot of gas, which equals 20,000 candle-hours per 1000 cubic feet. Therefore, 20,000 ÷ 800 = 25. In other words, to realize positively the same illumination with electricity as can be secured by consuming 1000 cubic feet of gas, 25 units and not eight would be required. Eight units would only supply 6400 candle-hours. How such a silly comparison got afloat as the one presented in the question, we cannot understand, seeing it is demonstrably inaccurate. It is the simplest thing in the world to show the inaccuracy within the walls of a photometer-room. On the revised comparison, the cost of the 77,000 cubic feet at the truly rural price (in normal times) of 3s. 5d. per 1000 cubic feet would be £13 3s. 1d. On the basis of 800 candle-hours per unit of electricity and 20 candle-hours per cubic foot of gas, 1925 units of electricity would be required to produce an equivalent illumination to the 77,000 cubic feet of gas. At the very low price of 4d. per unit for a town in which gas is sold at 3s. 5d., the 1925 units would cost £32 1s. 8d.; so that the difference in cost to the householder would be for equal illumination £18 18s. 7d. Now what explanation have the propounders of the question (who may not be Clark's College, but the author of a book used there) to make as to its absurd terms; and how many marks are allowed for the answer to the question which we have given here?

Household Refuse.

Refuse destruction used to be a fairly frequent subject of discussion in connection with steam-raising for electricity generation; but for some years it has gone out of fashion as a topic of debate. The fact is that combined dust destruction and steam-raising as economic factors in connection with municipal work do not constitute a subject lending itself to general discussion. While in one town the system allows a decent balance-sheet to be made out owing to the excellent burning character of the refuse, the moderate expense of collection through the lie of the town, and also the moderate cost of sorting, in another town the conditions may be altogether reversed, so that the experience of one town will not always fit another. In the "Electrical Times," the topic has been revived by an article contributed by Mr. L. L. Robinson, of the Hackney Electricity Department; and he does not think there is really very much in the system, judging from his own figures, as an economical method of disposing of refuse. In the correspondence the article has produced, one writer shows he is doing very well out of refuse destruction; but his district is as unlike the Hackney area as it can possibly be. But Mr. Robinson cannot see that the costs of refuse collection and destruction are likely to improve, owing to the increasing difficulties of disposing of the clinker, and the additional value put by labour upon its own exertions. In view of this, he suggests that it should be made compulsory for householders to consume the combustible portion of their own house refuse, which amounts to about 60 per cent. of the total; and the balance—the 40 per cent.—he would have them sort out into four bins, instead of putting it all into one. Into one bin he would have the ashes put; into the second, bones; into the third, glass bottles, crockery, and jam pots; and into the fourth, tins and other old metal articles. Mr. Robinson calls the present-day methods of refuse collection and disposal wasteful, and the plan he proposes an improvement. We can see landlords providing four bins instead of one; we can likewise see householders relieving the local authorities of the highly enjoyable task of sorting out refuse in the manner that he suggests. The gas industry goes one better than Mr. Robinson. It offers the householders methods of cooking and heating, which make no combustible refuse; and it suggests the use of very nice coke and refuse burning boilers, for maintaining a constant supply of hot water in the house. The beauties of this system are that local economy is largely served by entirely doing away with the collection of a large portion of the refuse at present made; that it reduces the number of collections to be made, and the amount of sorting at the local depôt; and that it does away with the necessity of a destructor, and the carting of a large proportion of the refuse through the streets. Altogether, the gas plan is a very sanitary one; and it is a wonder that it did not occur to Mr. Robinson to incorporate it in his article.

COAL STATISTICS FOR 1914.

Some Falling Off in Output.

THE first few months of war conditions, of course, affected the statistics contained in the Annual Report on Mines and Quarries for 1914, Part III. of which (dealing with output) was issued as a Blue-Book last week. Owing to the war, also, this part of the report, Mr. R. A. S. Redmayne (Chief Inspector of Mines) points out, has been considerably curtailed, so that the form in which the statistics are presented is likewise affected. Some of the tables with which those who are in the habit of studying the report have become familiar are on this occasion omitted—among them, those relating to exports and imports of coal. However, though the report has been pruned down from 130 to some 20 foolscap pages (and other minerals are, of course, dealt with besides coal and coke) there are still be found in it most of the figures which year by year have been quoted from it in the "JOURNAL" for purposes of comparison.

The output of coal in 1914 was 265,664,393 tons, of a value at the mines and quarries of £132,596,853. When compared with 1913, these figures show a decrease in output of 21,766,080 tons, and in value of £12,938,816; the actual totals for the year being an output of 287,430,473 tons, having a value of £145,535,669. For 1912 (the year of the great coal strike) the output was 260,416,338 tons, value £117,921,123; for 1911, 271,891,899 tons, value £110,783,682; 1910, 264,433,028 tons, value £108,377,567; and 1909, 263,774,312 tons, value £106,274,900. The average price of coal at the pit was 9s. 11·79d. per ton in 1914, compared with 10s. 1·52d. in 1913. The value of the coal at the mines for each of the preceding four years was: In 1912, 9s. 0·68d.; 1911, 8s. 1·79d.; 1910, 8s. 2·36d.; and 1909, 8s. 0·7d. Thus, though the figure for 1914 is something less than 2d. per ton lower than was the case in the twelve months immediately preceding, it is still very much higher than in any of the four other years named.

Of the total falling off in output for the year under review of 21,766,080 tons, there was a decrease in the English fields of 15,383,991 tons, in Wales of 2,782,814 tons, and in Scotland of 3,609,154 tons. Ireland, on the other hand, has a gain credited to it of 9879 tons. The complete figures for 1914 were: England, 184,545,577 tons, of a value of £89,523,440; Wales, 42,179,054 tons, value £25,530,993; Scotland, 38,847,362 tons, value £17,487,427; Ireland, 92,400 tons, value £54,993. The total output of anthracite (which is as usual included in the statistics relating to coal) for the twelve months was 4,718,993 tons, which was valued at £2,711,172. This is somewhat less than in the preceding year, when the output was 5,194,620 tons, and the value £3,089,847.

The customary table showing the prices of coal at the pit's mouth in the different fields is not included in the present report; but the figures are given for each county where coal is raised. From these it is seen that, in the case of England, the approximate price per ton of coal at the mines varied from 7s. 0·67d. in Worcester to 13s. 4d. in Westmorland; the average being 9s. 8·43d. For Wales, the highest figure was 12s. 5·48d. in respect of part of the output from Glamorgan, and the lowest 8s. 10·97d. for part of the coal coming from Carmarthen; the average working out at 12s. 1·27d. In the case of Scotland, Dumbarton was at the top with 10s. 11·58d., and Haddington lowest with 7s. 9·03d.; the average being 9s. 0·04d. With Ireland, the figures varied from 12s. 4·24d. in Kilkenny to 9s. 5·02d. in Tyrone; the average working out at 11s. 10·84d. As already mentioned, the average for the whole of the fields was 9s. 11·79d. per ton. The mean price of seaborne coal in the London market during 1914 was 21s. per ton. This was the same as in the preceding year; while the corresponding figures were 20s. 11d. per ton in 1912, 17s. in 1911, 16s. 3d. in 1910, and 16s. 11d. in 1909.

The quantity of coal exported (exclusive of coke and manufactured fuel and of coal shipped for the use of steamers engaged in foreign trade) was 59,039,880 tons, compared with 73,400,118 tons—or a decrease of some 14,000,000 tons. In 1912, the exports were 64 444,395 tons; in 1911, 64,599,266 tons. In the twelve months now under review, there was also, in addition to the quantity just named, the equivalent of 1,971,413 tons of coal exported in the shape of 1,182,848 tons of coke, and the equivalent of 1,446,981 tons of coal in the form of 1,607,757 tons of manufactured fuel. If to this there are added the 18,535,616 tons of coal shipped for use of steamers engaged in foreign trade, a figure is arrived at for the total exports of coal and coal equivalents of 80,993,890 tons, as compared with 98,338,104 tons in 1913, and 85,842,905 tons in 1912.

Of the exports during 1914 of coal as such, France received over 12¼ million tons, Italy 8½ million tons, Germany 5¼ million tons. In round figures, the quantity which was taken by France in 1913 was 13 million tons, by Italy 10 million tons, by Germany

9 million tons. Of the total quantity of 265,664,393 tons of coal raised in 1914, the amount remaining for home consumption for all purposes was 184,670,503 tons, or 3·977 tons per head of the population of the United Kingdom, as compared with 4·108 tons per head for the year before. In 1912, the quantity which remained for home consumption was equal to 3·823 tons per head of the population. Of last year's total, 36,289,010 tons were used in the manufacture of coke and briquettes, and 18,381,106 tons in the blast-furnaces for the manufacture of pig iron; these figures comparing with 39,560,489 tons and 21,223,607 tons respectively in the previous year.

Production of Coke.

The following four pages of the report furnish particulars with reference to the production of coke and briquettes and the number of coke-ovens in use in 1914. Returns of production of coke were received from 144 colliery owners (comprising 190 separate works), 1500 gas companies, and 21 other owners of coke-ovens. The counties of Durham and York furnished 64 per cent. of the total quantity of coke made in coking-ovens; 63 per cent. of the total number of ovens being worked in these counties. Of the 211 works other than gas-works where coking-plant is in use, bye-products—principally sulphate of ammonia and tar—were recovered last year in 103. This is a substantial improvement on 1913, when the figure was 88. With regard to briquettes, returns were obtained from all firms—mainly in South Wales—known to be engaged in the industry of manufacturing them; the material used being very fine slack.

The total quantity of coal used in the manufacture of coke in 1914 is put at 34,539,859 tons; the amount of coke obtained being 18,970,925 tons—7,920,669 tons from gas-works, and 11,050,256 tons at coke-ovens—of a total value of £13,252,526. In the previous year, there was an output of 7,830,736 tons from gas-works, and of 12,798,996 tons at coke-ovens; the total being 20,629,732 tons. Of the output from gas-works, 6,758,871 tons came from England, 155,930 tons from Wales, 806,763 tons from Scotland, 189,177 tons from Ireland, and 9928 tons from the Isle of Man. There were 16,975 coke-ovens in use; 9210 of them being of the beehive type. Of the remainder the four styles most largely in use were the Otto-Hilgenstock 1589, Coppée 1538, Simon-Carvés 1354, Semet-Solvay 1134, and Koppers 866. There were 1,840,465 tons of briquettes produced, of a selling price at the place of manufacture of £1,567,474.

Other Minerals.

The tables with regard to the output of bog ore and natural gas are not given; but the figures are not in either case usually of very large dimensions. During the year now being dealt with the output of iron ore was 8,984,492 tons, valued at £3,267,987, from mines, and 5,883,090 tons, valued at £653,696, from quarries in the United Kingdom. Thus the total output was 14,867,582 tons, the yield of iron from which was 4,786,090 tons, as compared with 15,997,328 tons in 1913. The output of oil shale from mines and quarries for 1914 was 3,268,666 tons. The average price per ton at the mines was 5s. 1·47d.; the total value being £837,249. The figures for 1913 were 3,280,143 tons, of a value of £822,394. The average yield of oil is put at 22 gallons per ton of shale, and of sulphate of ammonia at 44 lbs. The quantity of petroleum imported into the United Kingdom in the year under notice was 646,712,631 gallons; the value placed upon it being £12,756,207. This was 158,605,668 gallons and £1,899,401 value more than in the preceding year.

GAS-MANTLE METALS.

NO. 1.—CERIUM.

By James Scott.

[The diagrams by which the present article is illustrated were prepared by the author from enlarged microscopic slides.]

One of the most important, yet little known, industrial metals is cerium, which forms part of the substance of incandescent gas-mantles. Though the oxides of several metals—including aluminium and chromium—have been tested in connection with the manufacture and use of these inestimable articles of lighting utility, those composed of cerium and thorium still stand supreme. These are the main ingredients of the Welsbach mantle and its modifications.

A brief explanation is needed before the author describes the principal properties of the metal named in the heading. The mantles mentioned consist of fine cotton nets, which are dipped into a solution containing 99 per cent. of thorium nitrate and 1 per cent. of cerium nitrate. These proportions have been found to yield the most excellent results. When the amount of cerium is either larger or smaller, inferior results follow. Upon withdrawing and draining the nets, they get neatly covered with a nitrated film of the metals, and when this is ignited in the specialized form of burner it is at once oxidized and rendered incandescent. The film matter between the meshes gets burnt out, but is retained in the interstices between the cotton fibres.

Dealing in alphabetical order with the two components, cerium and thorium, the latter will claim attention in a subsequent article. Cerium is a comparatively rare metal, and was only a few years ago (owing to its former absolute scarcity) quite a mystery to most scientists. Even now it seems to be dealt with within a limited circle; so that the accompanying series of illustrations, prepared from the author's own experiments and observations, will be found fresh and novel. The metal is a constituent of many minerals, including cerite and orthite, which also contain kindred elements in conjunction with silica. For its commercial production its chloride is carefully electrolyzed. Lately, certain sand is used.

When properly isolated, cerium is a hard, heavy, lustrous steel grey metal; and will readily yield flashes of light and sparks when gently scraped with a pen-knife. Thinking that this phase was worth investigation the author held a glass slide between the base of his left-hand thumb and finger, while the tips of the same grasped a piece of cerium. By scratching the metal in the manner just described, some of the minute products of combustion were caught on the under-side of the glass, thereby becoming available for magnification. It was found that the friction caused the minute discharged particles to assume the form of spheres, which were dark in colour, and that these exploded on their own account if not interfered with. These shelled globules cut saucer-shaped depressions into the glass against which they struck. Most of these objects were caught before they had time to glow to extinction, though some of them had burst and scattered their contents around on the glass.

By making close observations on the procedure through the microscope while the sparks developed, the following conclusions, aided by the preceding facts, were arrived at.

No. 1.—A Piece of Cerium that has just been scraped with a Knife-edge. Brilliant Flashes and Sparks are instantly caused.

In fig. 1 is depicted a view of the sparks formed after cerium has been scratched. In the usual course of conduct, particles, as they are ejected from the cerium, become white hot, and, as a result of melting and projection, are moulded to globular shape. The contents get hotter still, owing to the formation of a surface shell round the globule, which thus encloses them; and, in consequence, they force their way outwards, still glowing. There is no doubt that the larger pieces thus removed become spherical and repeat the manifestations, but on a reduced scale. All the movements, however, occur within a second or so, and it is not an easy matter to follow them. This phase is worth studying.

Cerium oxidizes very rapidly, and needs the closest protection if it is desired to keep it in its purely metallic state. The bright surface is succeeded by a dull one; and it gradually breaks-down into a fine grey powder. Upon magnifying an undisturbed piece of the metal in this condition, it was found that it consisted of exceptionally minute particles; the specks being detachable at the slightest touch. Prior to this development, the surface was fairly even and smooth. It then cracked into small lumps, and these again divided into more minute ones, until finally the metal had been transformed into the merest specks.

An effective way of demonstrating the incandescent qualities of cerium oxide is to place some of the powder on the end of an erect rod of carbon and concentrate the flame of a blow-pipe upon it. It will soon sparkle and flash most brilliantly, and give a bright, luminous flame. Similar phenomena follow if the oxide is dropped upon a red-hot poker, or into a fire.

It should be remembered that the salts of a metal are often as valuable in many directions as the metal itself. A metallic salt, although it is apparently so different from its metal, is practically a modification of it, and can generally be made to yield up the metal by means of suitable decomposition. Briefly stated, the burning of an ordinary gas-flame results in the production and wasting of heat with a consequent loss of luminosity. Carbon

No. 2.—A Magnified Pin-hole View of Cerium dissolved in Hot Sulphuric Acid, producing Peculiar Prismatic Crystals.

molecules are ejected in clouds, and first get simply heated without revealing their presence. Hence the inner invisible part of an ordinary gas-flame looks opaque and black until something is held close behind it, when it is found to be transparent. As these heated molecules rise, they become white hot, and visible as the luminous flame. They finally vanish in a gaseous state into the surrounding air. The blue, inner layer of flame, or core, is the beginning of luminosity—its supply of oxygen being small. By substituting a suitable metallic oxide for the carbon, and using a burner constructed on the bunsen principle, the heat produced acts on its particles and causes them to become uniformly white hot—*i.e.*, incandescent.

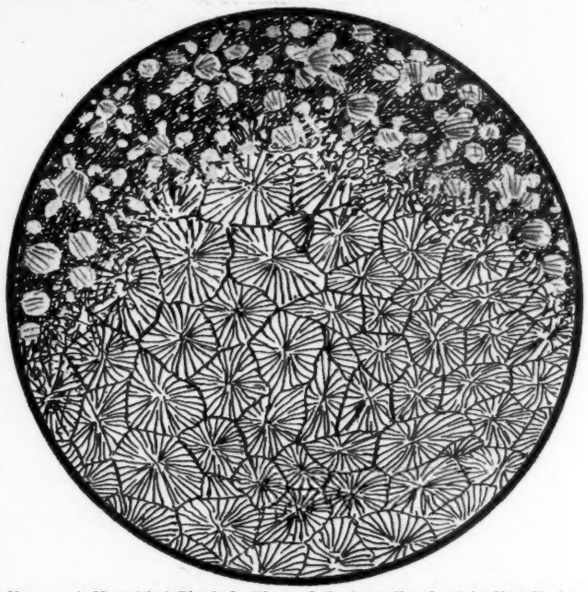
The chief salts of cerium are orange red in colour; while the bulk of the remainder are yellowish. In many cases, however (especially when dealt with microscopically), they are transparent white, or, more correctly speaking, glassy-white. The results of the author's experiments in connection with the metal and the three most-used acids—nitric, sulphuric, and hydrochloric—may prove interesting. In each case a few drops of the concentrated acid were placed on a glass slide, and a small scrap of the metal then introduced. The results thereafter obtained are described in the following lines.

The substances were first heated, and it was found that the nitrated metal produced an amorphous or a semi-crystalline salt, which, however, was so deliquescent that it quickly redissolved. It was during the latter phase that the tendency to become crystalline manifested itself. This moisture attraction was quite a common feature among the heated compounds of cerium and acid. Similar shapeless products occurred when the acid and dissolved metal were left in the cold state. When the diluted acid was used, nothing particular in the way of contrasts was noticeable, whether heat was, or was not, applied.

The conduct of sulphuric acid in connection with cerium was very attractive, and minutely various. Upon heating the compound there rapidly formed a glistening powder, which, upon magnification, was found to be entirely crystalline, as shown in fig. 2. Within a short time the objects began to dissolve away, and there were substituted for them some very bold rhombic crystals.

It will be seen that among the prisms are some globular forms, which, by halving and the intervention of narrow connections, become dumb-bell shaped. In some cases they resemble two fans with the handle-points placed together.

When the cold acid alone was used, there first appeared exceedingly minute and transparent, yet perfectly geometrical, crystals, of the kind shown in fig. 3. The next day the crystals that had formed were large, beautifully symmetrical, and clear. Some of them, selected and transferred from another slide, are arranged round the margin of fig. 3.

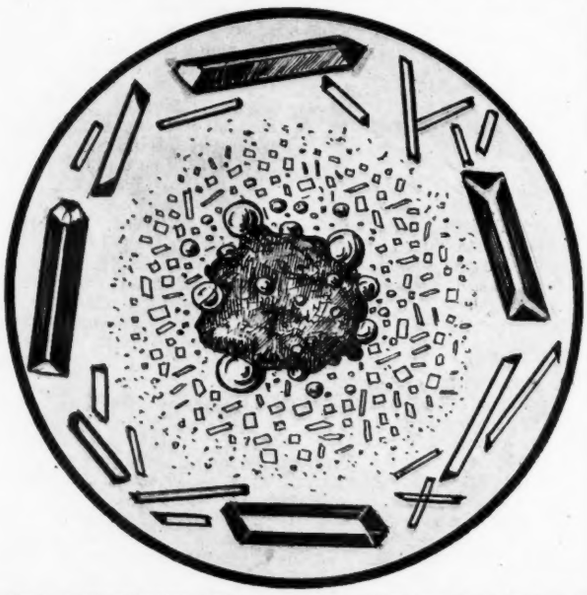


No. 4.—A Magnified Pin-hole View of Cerium dissolved in Hot Hydrochloric Acid. It is deliquescent, and reforms into Boat-shaped and Pointed Flakes.

The diluted acid and metal, when heated, produced some pretty rosettes, tufts, and hexagons. When left cold, the result was similar to that of the cold concentrated acid, but less striking.

Some very neat effects were occasioned by the interaction of the metal and hydrochloric acid, when heated. If not too thick, the film formed into a polygonal pattern, with rosetted figuring in each mesh. In the crusty portions, an opacity was produced, among which perforations were frequently arranged in the manner depicted in fig. 4. These things deliquesced to a mass of boat-shaped, scaly, and notched flakes arranged very peculiarly.

The cold acid yielded small spheres, mostly creased and folded, and some mimicked roses seen in the top view. The diluted acid, when heated, caused similar results to the concentrated one; but of less effective character. Diluted acid, left cold with the metal, yielded weaker replicas of that engendered by the strong acid.



No. 3.—A Magnified Pin-hole View of a Scrap of Cerium dissolving in Cold Sulphuric Acid, producing Minute Crystals. The larger crystals form later on.

Loss of Bye-Products in Beehive Oven Coke Making.—According to the fifth annual report (issued on the 21st ult.) of the Director of the United States Bureau of Mines, for the twelve months to June last, the value of the bye-products annually lost in the States through the coking of coal in beehive ovens amounts to more than $40,000,000. The wastefulness of the beehive oven has long been known; but only recently, he remarks, has the pressing need of recovering these bye-products and of building-up a bye-product industry—including the manufacture of dyestuffs and other coal-tar derivatives—been made clearly evident. The Bureau has often called attention to the possibilities of the bye-product industry and to the work necessary for its upbuilding.

Southern District Association of Gas Engineers.—Mr. H. C. Head, of Winchester (the Hon. Secretary), is sending out a circular to members informing them that a meeting of the Association, at which it is expected that Mr. F. L. Halford, Mr. H. O. Carr, and Mr. W. Doig Gibb will be present, will be held at 2.30 on Thursday, the 27th inst., at the Royal Society of Arts, Adelphi, when an informal discussion will take place on toluol, the extraction of explosives, the disposal of tar and dehydrated tar, oil washing, naphthalene, &c. The proceedings will be confidential, and will not be reported in the Press. After the meeting, tea will be served. The President (Mr. J. W. Auchterlonie, of Cambridge) feels that in the national work of the provision of toluene and other explosives the Association should take an active part, and trusts all the members will make a special effort to attend.

INDUSTRIAL GAS: ITS SERVICES TO THE NATION.

By H. M. Thornton, M.Inst.Mech.E.

On the invitation of the Derby Society of Engineers, Mr. H. M. Thornton, of the Richmond Gas Stove and Meter Company, Limited, yesterday (Monday) evening, delivered a lecture, illustrated by lantern slides, on "Industrial Gas: Its Services to the Nation." The Sessional Chairman of the Society (whose meetings are held in the Lecture Hall of the Mechanics' Institute) is Mr. J. Ferguson Bell, M.Inst.C.E., the Engineer and Manager of the Derby Gas Company; and gas engineers from neighbouring undertakings had been invited by him to be present to hear the lecture.

My subject to-night, I am glad to say, is of immediate and practical interest. During this time of crisis that our nation is passing through, our standard of value—both of individuals and of industries—is the contribution that is made to our national strength. Judged by this standard, our topic this evening "Industrial Gas"—or, to put it more clearly, "The Use of Coal Gas for Industrial Purposes"—will not be found wanting. The measure of opportunity is the measure of responsibility; and your Chairman would be able, better than myself, to tell you of the immediate and complete response that was made by the gas industry in all its branches to the demands created by the requirements of the Government. It is, however, the uses of gas rather than its manufacture with which I want to deal to-night, and, as the title of the lecture indicates, "Its services to the nation"—to which might be added the words "In time of war."

I should have liked—and I am sure that it could not have failed to have been of interest to you—to have dealt to-night with the multifarious practical application that has been made of gas in our principal manufacturing processes. The limits of time at my disposal prevent my going into these in detail; but anyone who would like information on the subject will find it in my lecture to the Royal Society of Arts in March of last year, when I dealt with the "Uses of Coal Gas for Industrial Purposes."* To-night, however, in this time of war, I wish to devote my paper to the part which gas is playing in the manufacture of munitions; and even here I must omit reference to munitions of war other than those composed of metals, chiefly steel. It would be desirable, first, to briefly describe some of the representative gas-furnaces used in the production of war materials—viz., shells, cartridge cases, machine-gun barrel hardening, sword and bayonet forging and hardening, aeroplane, submarine, and motor-engine parts, army transport vehicles, &c., &c.

Representative Furnaces.

The gas-furnace found its first useful application in metallurgical laboratories in the form of enclosed bunsen burners, small muffle, and injector furnaces, by the use of which the research man soon discovered the reliable qualities of coal gas as a heating agent. These laboratory appliances, however, were not of that practical character necessary in the industrial operations, as the time occupied and the cost of fuel were not important factors in the pursuits of the scientist and chemist. The stage of development at which gas-furnaces have to-day arrived from these early beginnings has been the result of prolonged investigation of practical requirements. It is not my intention this evening to recount any of the successive stages through which the gas-furnace has passed; but it is now an accepted fact that for large and small industrial heating operations gas-furnaces have achieved a positive success, and that their application is well established for a great variety of heat treatments—carburizing, re-heating, hardening, annealing of steel and non-ferrous metals, glass-blowing and annealing glass, and a hundred other interesting applications that have been the subject of lectures on several occasions.

During recent years we have witnessed continuous progress in the production of all kinds of machinery and special mechanical tools. A glance at the leading engineering papers reveals the enormous amount of work which has brought machinery and its component parts to such a marvellous stage of subdivision, perfection, and efficiency. In the earlier days of engineering, when machinery was in most cases run at comparatively low speeds, the blacksmith's hearth was considered suitable for the restricted demand for what we term to-day "heat-treatment"—I refer, of course, to the heating operation of the smaller parts of machinery and tools produced at that time. Gas-furnaces have grown apace with these developments; and their application to-day in the production of war materials is positive proof of the numerous claims that have been put forward advocating their use in place of the more crude methods pursued in the heat treatment of metals.

Design of Gas-Furnaces.

It would be a mistake to assume that one particular type or design of furnace is of universal application. A furnace that can be used for any kind of operation is probably not much good for any one of them. We must discriminate; and experience has shown us that the more useful types may be divided into three distinct classes:

A.—Natural-draught furnaces, which may in the great majority of cases be used for temperatures up to 800° C. or thereabouts, and in some cases above.

B.—Furnaces with gas at low pressure and fan draught, suitable for temperature between 800° and 1400° C.

C.—Low-pressure gas and air blast, or high-pressure gas, for small furnaces where high working temperatures are required in a small furnace chamber.

Natural Draught Furnaces.

Adverting to the first-mentioned system—the natural draught regenerator oven furnace—this is heated with a series of bunsen burners which enter the combustion chamber of the furnace. Combustion is supported and intensified by secondary air entering the combustion chamber, playing under the furnace floor, and surrounding the walls and roof, causing a radiant heat to be equally distributed over the whole area of the furnace. This type will heat up from cold to a temperature of 800° C. in from 50 to 60 minutes, when the furnace walls become thoroughly soaked with heat. It is possible to work under the most desirable conditions—viz., "non-scaling," if not altogether a reducing atmosphere—by simply regulating the secondary air supplies and flue dampers, which adjustment will differ according to the local conditions of gas supplies—viz., the calorific value and pressure at which gas is delivered at the furnace. For the light operations of re-heating gears and such work, this type of furnace will be found most satisfactory.

Up to quite recently—notably in America—gas with air blast was exclusively used for low-temperature work; but there are objections to the use of gas with air blast for low-temperature work in oven furnaces. If a temperature of 750° C. is to be maintained in an oven furnace—say, 3 feet deep by 2 feet wide by 1 foot high (a standard size)—the natural-draught regenerative system will give an even and soaking heat; but if gas and air blast be used at such low temperature, the heat in the furnace chamber is invariably found to be uneven, because the local heating or blow-pipe effect of the several gas and air-blast burners will not distribute heat at this low temperature in such an even manner as the natural-draught system. To further illustrate the efficiency of this furnace, I may state that temperatures up to 1300° C., or 2373° Fahr., have been obtained, which is a fine achievement for natural draught.

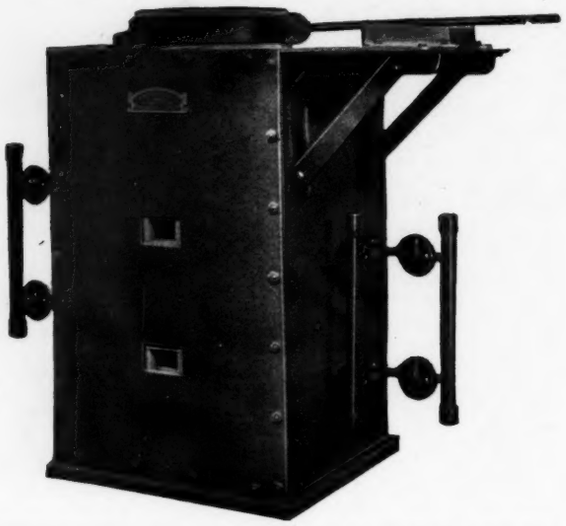
Another furnace, resembling this one in design, is the natural draught reverberatory oven furnace. In one point this differs essentially from the previous furnace—viz., its combustion chamber is the working chamber also. Like its precursor, it is on the natural draught principle, requiring no mechanical draught for air compression. It is heated on the reverberatory idea. The gas enters the furnace chamber, and preheated air runs along the furnace bottom through fire-clay nostrils; the hot air meeting the burner mouth at the point where combustion takes place. The flame then passes along the underside of the furnace roof before entering the flues underneath to the furnace floor, which is of exceptional strength to suit the heavier class of work. This furnace is quite satisfactory for working temperatures up to 1000° C.—viz., for carburizing, re-heating, &c.—and is a very suitable type for use where there are no convenient means of employing power-driven fans. The brickwork or linings are very substantial, and absorb a good reserve of heat, on account of the tortuous way through which the heated products of combustion travel. It is possible to hold one's hand over the head of the flue of one of these furnaces after it has been in operation for six hours on case-hardening work—a continuous temperature of not less than 950° C.

Low-Pressure Gas and Air Furnaces.

A new method of heating furnaces has recently been introduced, known as the "L.P.G.A." system (low-pressure gas and air). The principles involved have been successfully applied to the oven furnaces, also for forging work and for metal melting. For the last-mentioned work, the furnace can be constructed in either the crucible or oven type. In the "L.P.G.A." furnaces, means have been adopted to heat the whole of the air supply necessary for combustion, which takes place in the furnace chamber in such a manner as to render it unnecessary to employ the usual bunsen burners with a secondary air supply. Combustion of the mixture of gas and air is so near perfection that no excess of air is required, and therefore no heat is dissipated by the carrying-off of the excess air at a high temperature, as is the case with furnaces less well regulated as regards the admission of air. The combination of the entire preheating of air with the complete theoretical proportions of gas and hot air results in very economical working; the only heat losses being those necessarily incurred by slight radiation from the outside of the furnace and from the flues.

The working of the "L.P.G.A." furnace may be briefly described as follows: Town gas at the normal pressure enters the furnace chamber through a series of tubes from the gas-main supply. Air at approximately 2 inches water-gauge—the same pressure as the gas, or thereabouts—enters the fire-brick lining of the furnace

* See "Journal," Vol. CXXIX., pp. 743-750.



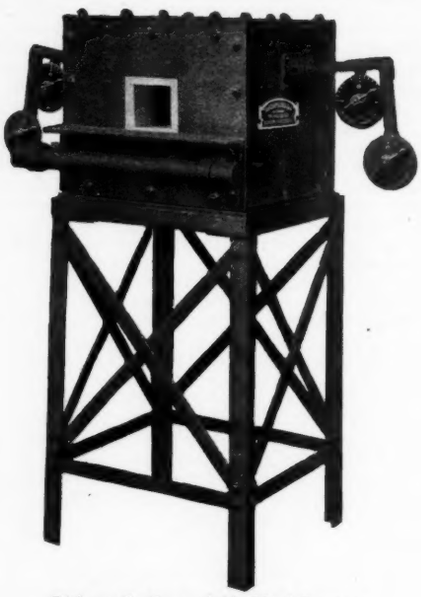
Richmond's Vertical Hardening Muffle Furnace for Machine-Gun Barrels.

through a series of tubes from the air-main supplies, and travels down the side and along the bottom of the furnace through the fire-clay tubes. The air, thus efficiently preheated, meets the incoming gas as described above, at which point combustion takes place. The products of combustion then pass along the underside of the furnace before entering the flue or flues, the air for supporting combustion above described being preheated by the waste products. The local heating effect of the blast flame and the usual combustion chamber are thus obviated.

A reducing atmosphere may be maintained under the most economical conditions by simply diminishing the pressure at the air-main. Air is usually supplied by a fan; so that the expensive blowers, with their costs for power to drive them, can be dispensed with. By the use of valves or cocks upon the main gas and air supply pipes, the furnace may be regulated for temperatures to a very fine degree. It is usual to fix pressure gauges on the outlet side of the cocks or valves; so that having first arrived at the correct respective pressures of gas and air to give the results desired in the furnaces, the subsequent regulation is simple—it being only necessary to close or open the valves to give proportionate pressure of gas and air. For example, the pressures of gas and air to give a certain temperature are respectively 10·10ths and 8·10ths of an inch. To reduce the consumption to one-half, the valves are reduced to 2·5 inches for gas and 0·2 inch for air, when the exact mixture as before the reduction is maintained.

This method of regulation saves a great deal of trouble, obviating the adjustment of numerous gas and air cocks. Local adjustment can be made. if desired, by the usual taps or gas inlets and slides on the air tubes. It is desirable (particularly where a non-oxidizing atmosphere is required) to work the furnace with a slight pressure inside it—*i.e.*, a small amount of flame should come out of the peep-holes in the door when these are open. This prevents the indrawing of air through the door—a condition which should be avoided in the construction of furnaces.

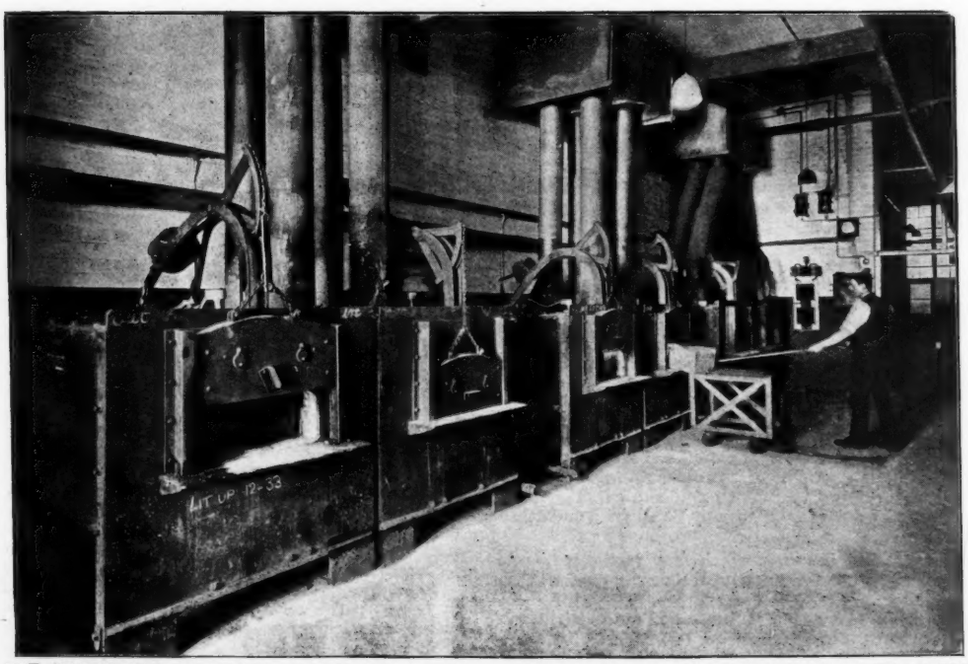
Each flue is efficiently controlled by double dampers; and it cannot be too much emphasized that, in order to obtain the best results in this or any other furnaces, the flue regulation must be looked to when altering the rate of combustion. When the above-mentioned details have been attended to, a perfectly even temperature throughout can be depended upon; and the conditions



Richmond's Gas and Air Blast Furnace.

of heating can be either neutral, reducing, or oxydizing. The floor of the furnace may be constructed to take any weight of material desired per square foot; bricks may be used in lieu of floor tiles. Furnaces can also be of the bogey type if required. For forging furnaces, crucible, and lead and salt bath hardening furnaces, the principles of construction are the same, with some slight modifications.

From the point of view of economy in gas consumption, steel has recently been annealed in an "L.P.G.A." furnace capable of taking eight or nine tons with a consumption of 3000 cubic feet per ton, when six tons were being treated per charge. It is anticipated that even better results will be obtained with the furnace



POT HARDENING COMPONENT PARTS OF RIFLES IN RICHMOND'S REVERBERATORY OVEN FURNACES.

working at full load—viz., nine tons. The reheating of billets for rolling has been achieved in Sheffield at the rate of under 3500 cubic feet per ton; the material being heated to over 1100° C.

A point worthy of note is the complete absence of noise usually prevalent with gas and air blast furnaces, which is a matter at times worth consideration where a number of furnaces are working together in one shop.

The absence of cutting heats, which destroy brickwork and tiles, is another advantage, and means that the furnace lining will last much longer.

Gas and Air Blast.

The third type of furnace is that worked by gas and air blast. When only a small working chamber is required, and of insufficient dimensions to give heat from the brick linings to preheat air used for supporting combustion, then we revert to air blast. The use of gas and air blast furnaces may be limited to the tool room, for pre-heating and hardening of high-speed boring and planing tools, &c. In the case of a small twin-chambered blast-furnace for hardening the noses of planing and other lathe tools, the upper chamber is heated with the waste products of the lower; and the furnace will reach a white heat, starting from cold, in about 20 to 25 minutes, with a gas consumption of about 100 cubic feet per hour.

Another blast-oven furnace suitable for hardening milling cutters, taps, dies, &c., measures, internally, 18 in. by 15 in. by 9 in., and will in one hour heat up to 1300° C. to 1400° C., which temperature can be maintained for about 400 cubic feet of gas per hour. This furnace has a rectangular chamber cased with brickwork; the outer casing of the furnace being of wrought iron and castings, strongly braced together. The gas and air blast burners in this type of furnace enter at the top of the furnace. The action of the flame under the arch forms a quarter of a circle, and splits itself at the bottom of the furnace chamber. In this way the air-blast flame does not impinge on the work to be heated up. The furnace flues are constructed in such a manner that, whether the lifting door be opened or closed, it is possible to work with a reducing atmosphere, which is a most desirable condition when hardening high-speed steel.

The three classes of furnaces described—viz., natural draught, low-pressure gas and air, and gas and air blast—comprise the three principal types of modern gas-furnaces at the stage of development they have reached to-day.

[The lecturer showed on the screen a group of forty representative types of furnaces which indicated the progress that has been made in the practical application of gas-furnaces to almost every industry, and then proceeded to the main theme of the lecture.]

THE SERVICE OF GAS IN THE PRODUCTION OF MUNITIONS OF WAR.

At this critical time in our national history, those of us who are engaged in the gas industry are naturally gratified at the large extent to which gas is used in the production of armaments and ammunition in factories, shipyards, and Government works. It would hardly be too sweeping a statement to say that all the requirements of our Army and Navy are under tribute to gas in some way or other. Of my own personal knowledge, I know that the enormous output of war materials we have received from our manufacturers could not have been so rapidly made without the aid of industrial gas appliances, many of which, in their present economical and effective form, are of comparatively recent introduction. It is, I venture to claim, largely due to the service of industrial gas apparatus that our new armies were in a position to take the field much earlier than could otherwise have been the case.

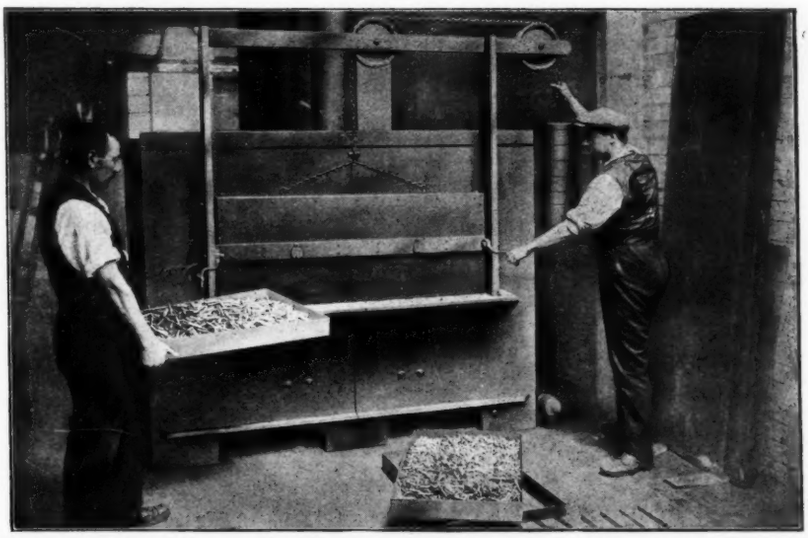
Commencing then with the basic product. Manufactured steel, in bars, is sent out by the makers in an annealed condition; and for this purpose gas-furnaces are being increasingly used. A slide shows two steel bar annealing furnaces. These are approximately 16 feet long, from which fact it will be obvious that they consume gas on a fairly large scale. Annealing in coal-furnaces necessitates packing the bars in a heavy cast-iron box to prevent the scaling of the steel. This box is considered by some to be unnecessary in the gas-furnace, in view of the uniform conditions under which gas-furnaces work. The elimination of the box naturally means less absorption of heat. Decreased labour is also an important factor—in short, gas annealing has been very economical. In many of the smaller steel works, where annealing is intermittent, the saving achieved by the use of gas-furnaces is something like 50 per cent. in the cost of fuel alone—a factor in works' economy which cannot be ignored by manufacturers in these days of keen competition.

The same operation can be carried out in a "L.P.G.A." furnace. This furnace will take a load of about 2½ tons, and will anneal carbon steel in bars at about 3000 cubic feet of gas per ton. The method is briefly as follows:

1.—The steel bar is charged into the cold furnace.

2.—The heating-up is accomplished in six hours, or thereabouts, with frequent thermometer readings.

3.—All dampers and secondary air nostrils are carefully closed, and the furnace and contents cooled down very slowly.



RICHMOND'S NATURAL DRAUGHT REGENERATOR FURNACE FOR ANNEALING BRASS CARTRIDGE CASES.

The following are figures from actual commercial working results in Sheffield:

Annealing Steel.

	L.P.G.A. Oven Furnace.	Natural Draught Regenerator Oven Furnace.
Weight of charge	6 tons	1¾ tons
Total time of heating	3 hrs.	6 hrs.
Total time of cooling	45 hrs.	42 hrs.
Total time of operation	48 hrs.	48 hrs.
Maximum temperature attained	850° C.	850° C.
Gas consumption per ton of steel annealed	3000 cubic feet	3600 cubic feet

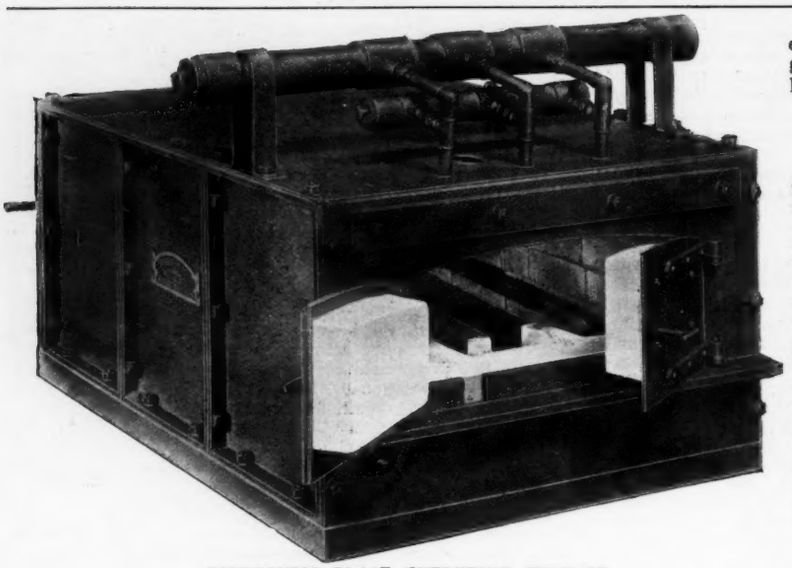
It will be seen from these figures that the "L.P.G.A." oven furnace worked with an economy in gas consumption of something like 20 per cent. less than the natural draught regenerator oven furnace.

Steel annealed in the "L.P.G.A." furnace is free from scale, and the annealing is, if anything, more uniform. This, in addition to the time and space saved, and (as already mentioned) the omission of the packing boxes, proves the superiority and economy in using town gas for this purpose to be established facts.

Steel billets for many purposes are also annealed or normalized in gas-furnaces. "L.P.G.A." furnaces have been found to be particularly well adapted to this purpose, on account of the strong floor before described, and the excellent conditions of annealing in a reducing atmosphere. This furnace will take a charge of 5 tons; and the process shown is that of normalizing, before rolling or forging, or other operations. Natural draught furnaces can be used for a similar purpose.

Furnaces Used in the Production of Shells.

From the steel bar and billet, we pass, naturally, to the all-important subject of shells. The heat treatment of shells—a



RICHMOND'S BLAST EXTRUDING FURNACE.

matter of vital interest to our national existence at the present moment—is largely carried out by the use of gas-furnaces; and the extension of their use in this direction is a matter of daily occurrence. Some of these furnaces are comparatively small; but even the largest shells are to-day being treated in this country in gas-furnaces. One of these furnaces measures inside 8 ft. 2 in. deep by 6 ft. 3 in. wide by 7 ft. high, and is capable of annealing or heat treating ten 15-inch armour-piercing shells at a time. The furnace is fitted with a lifting roof or arch; and the "L.P.G.A." system (as before described) is utilized here to advantage. This is one of the many large town-gas furnaces in use. There are over 10 tons of castings in the construction of the outer casing of this furnace. Large gas-heated furnaces are also in operation for oil-hardening these naval armour-piercing shells.

Reverting to the eighteen-pounder shrapnel shell, and the 4·5 and 6 inch high explosive shells, there are a very large number of furnaces in use for heating these two latter shells for the heading or nosing process; but it is no doubt generally known that this process is being discontinued in favour of screwing on a nose made from a drop forging. This, to some extent, eliminates the use of gas-furnaces for this particular process; but there are other operations in which gas-furnaces are almost indispensable.

Annealing Brass Cartridge Cases for Shells.

Having dealt with the "body" of the shell, gas oven-furnaces are also being used on a large scale for annealing the brass cartridge cases. A slide shows the first portion of an installation, illustrating four oven-furnaces, each 12 ft. by 4 ft. by 2 ft., for annealing 4·5-inch cartridge cases in trays. You will be aware that the cartridge made from a blank has to be annealed between each drawing operation, when it is necessary to have the oven evenly heated at a temperature of about 700° C. The type of furnace used is the natural-draught regenerative oven furnace previously described.

Annealing Copper Bands Prior to Shrinking-on Shells.

The two previous operations do not exhaust the uses of gas in the production of shells. A large number of natural draught reverberatory furnaces are in commission for annealing the copper bands prior to shrinking-on. Some users specify gas with air blast to enable the operation to be carried out more rapidly; but from experience gained, and of sufficient time to verify, I have no hesitation in saying that the natural-draught reverberatory furnace will satisfy the most exigent requirements.

Drying Ovens.

Finally, in connection with shells, there is the drying oven and trolley. The former is heated with either luminous or bunsen flames placed around the bottom side of the oven, which is fitted with a double case through which the hot products pass. Trolleys of different shapes and dimensions are specially constructed to take the desired number of shells. The object of drying the shells is to harden the varnish placed in the interior, and this prevents any possibility of oxidation from the steel should the shell be kept in stock some time. This condition, however, is one not likely to be experienced, as we hope to "deliver the goods" with promptitude into the German lines.

Furnaces Used by the French for Bottling Shells.

Before passing from this subject, it will be interesting to describe the furnace used by the French and Belgian shell factories for "heading" the famous 75 mm. shells. It is strongly made, and the top part, which looks like a turret, revolves upon ball-bearings—the speed being completely under control. The turret revolves very slowly, and the heating capacity of the machine is 120 shells per hour. As the heating chamber is restricted, gas and air blast are used. A single and powerful burner plays on the bottom of the furnace from the top, and the hot gases find their exit from flues on the top of the furnace. When each hole contains a shell, by this heating arrangement the end of the shell only is heated, with the accuracy which is so essential a condition. This particular furnace is built in this country for our Allies.

From the subject of the heat treatment of shells, which is of absorbing interest, we come to another equally important branch of munition work—viz.:

FURNACES USED IN THE PRODUCTION OF SMALL ARMS.

Annealing Rifle Breeches.

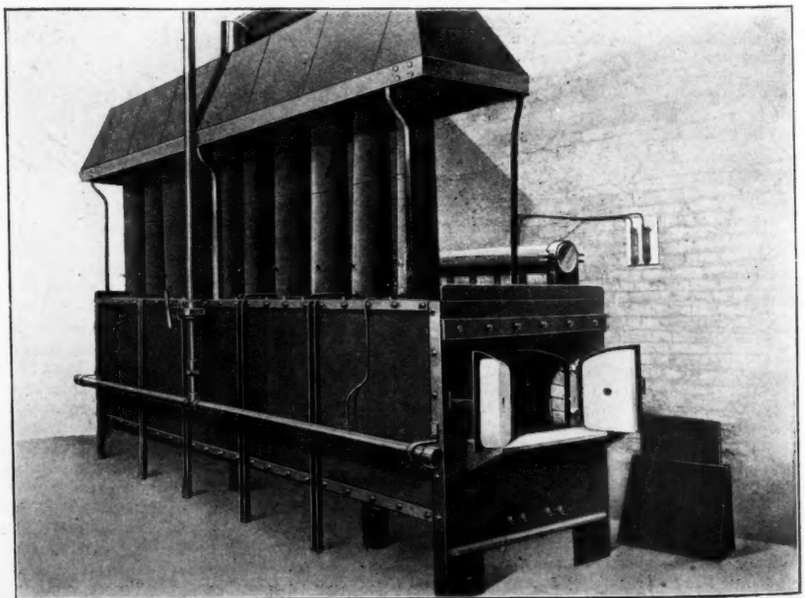
The earlier method was to anneal these in boxes, packed with charcoal in a coal-fired furnace, or in coal-fired retorts or muffles. A specially designed reverberatory gas-furnace, with side guard tiles, is now in very extensive use in various small arms factories. The forgings are simply placed in the oven and piled-up to the side guard tiles, which keep them free from flame contact, by which means the annealing is carried out both with efficiency and economy.

Other component parts of rifles require to be case-hardened; and here again the gas oven-furnace is used in the same way as for case-hardening generally. The component parts are packed in boxes along with carburizing material, and the natural-draught furnace system proves quite satisfactory.

Hardening and Tempering Bayonets.

The rifle is incomplete without the bayonet; and in two operations at least connected with this weapon gas is being used. First, the hardening and tempering of the bayonet blade is carried out in two different types of furnaces. The hardening operation is achieved in a natural draught regenerative furnace, of oven or muffle type, in which the bayonets are brought up to the hardening temperature and quenched, after which they are placed in a metal oven which is regulated for tempering. The two operations have to be carried out with the greatest care; and a large proportion of the bayonets manufactured for small arms are dealt with in these gas-furnaces.

We have now described, very summarily, the heating operations through which the rifle and its bayonet pass. Then, naturally, comes the subject of the ammunition.



ANNEALING CARBON AND HIGH-SPEED STEEL IN RICHMOND'S "L.P.G.A." OVEN FURNACE.

Cartridge Cases and Clips.

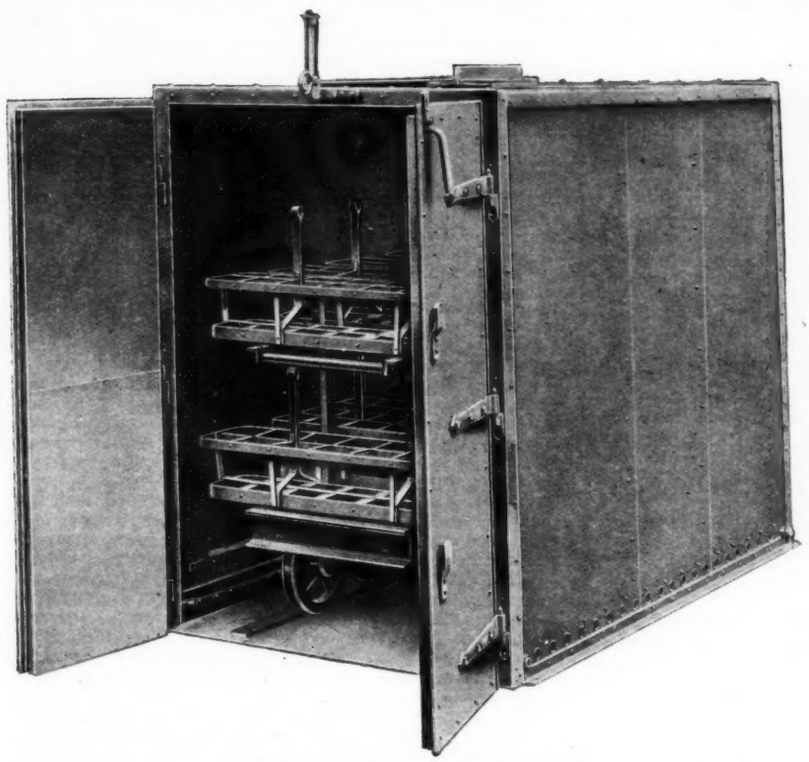
In two directions gas-furnaces are being largely used—viz., the annealing of the cartridge cases, and the tempering of the cartridge clips. For the first-mentioned operation, the cartridge cases are placed in pans, and annealed at a temperature of about 700° C. The second operation is the tempering of cartridge clips. These clips are made in huge quantities from thin steel, automatically pressed into shape. The operation is the tempering and colouring of these cartridge clips. Each furnace deals with about 10,000 clips per day, making an appreciable contribution to our stores of munitions.

Annealing and Hardening Barrels of Machine Guns.

We have all been highly interested in the revelations made by the Minister of Munitions in his recent speech regarding the subject of machine guns. It is only too apparent the reliance which the enemy has placed upon his preparations in this arm; and it is pleasing to feel that in our national efforts to overtake his superiority gas has played a not inconspicuous part.

Furnaces Used in Manufacturing Aëroplanes.

If there is one branch of military and naval work on which there is particular reason to congratulate ourselves, it is, I suppose, our magnificent air service. The development which has been made so rapidly from small beginnings, and the ascendency gained over the enemy by our intrepid and skilful pilots, are both



RICHMOND'S SHELL-DRYING OVEN.

phenomenal. Here, again, in the construction of the aëroplane, gas has earned its badge "on war service."

The oven-furnaces before described are used for the thermo-treatment of motor gears and constructional pieces which have to be carried out with a maximum of accuracy. The great need of this will be quite understood, as each component part of an aëroplane, whether it be the gearing of the motor or the joint pieces, the wire streamers for bracing-up the structure, all require the utmost exactitude in their thermo-treatment, within a few degrees centigrade. I would call attention to an interesting lead bath for annealing wire streamers in molten lead. It is a furnace 6 feet long, which is heated with down-draught burners and secondary air supplies for preheating the air. These furnaces have proved very successful; and lengths up to 15 feet and more are now in daily use for this operation in several aircraft factories.

Gas-furnaces are also used on a large scale for the heat treatment of nearly all the component parts of the structure. In such important instruments of warfare and of delicate adjustment, every part is naturally subjected to the most careful inspection after the heat treatment before it is allowed to be incorporated in the machine; and it is no mean tribute to the reliability of gas-furnaces that the results should have given entire satisfaction.

Armoured Cars.

Closely allied, I believe, to the Naval Air Service, is the armoured car branch. Gas oven-furnaces of the "L.P.G.A." type are extensively used for the heat treatment of nickel steel and other kinds of steel. To secure the highest bullet-proof conditions compatible with lightness, careful and precise treatment is necessary; and gas-furnaces, with their perfect control of temperatures and their constant and unvarying heats, have been ideal for this purpose.

Motor Transport.

Not only for the armoured car, but for all motor-cars for the Army Service Corps, general transport, &c., gas-furnaces are in requisition. One of the slides illustrates part of the hardening shop of an important motor and engineering works associated with a famous armament company. All the furnaces use gas as fuel; and since the war started, additional ones have been installed, greatly assisting the output of gear parts, &c. The principal work of this shop is the thermo-treatment of gear parts.

Some motor factories heat-treat cam-shafts in oven-furnaces; but a good deal of skill is required in getting them perfectly horizontal, besides which one has to consider that only certain parts of the shaft are hardened, other parts being left soft and tough. In order to carry out this operation, some clever devices have been thought out. When packing into boxes filled with carburizing material, the part of the shaft which is not to absorb carbon is covered with clay; or, again, other motor works have an electric copper bath for depositing copper on such parts of the cam shaft as do not require to be case-hardened with the carburizing material before referred to. Further, in order to avoid warping, which, of course, is only overcome by the most skilful handling in horizontal oven-furnaces, vertical furnaces have been designed for this operation on the lines described.

Another important component of the motor gear engine is the magneto. Hitherto, we depended on Germany almost exclusively for the production of magnet steel; but, since the war, British steel makers have directed their attention to its manufacture. Here, again, the gas-heated oven, or muffle furnace, is used with great advantage for exact heat treatment.

Furnaces for Accessories Necessary to the Production of War Munitions.

I have now given you a few particulars of furnaces used in the production of ordnance and other war material, and, finally, we come to the tool-room requirements—*i.e.*, the production of such tools as milling cutters, reamers, planers, slotters, taps and dies, &c., which have been increased greatly to cope with the enormous production of ordnance. It is very important to have suitable furnaces for the thermo-treatment of such high-speed tools. It will be realized how very necessary it is to heat-up any high-speed tool gradually, before it reaches the hardening temperature—somewhere about 1300° C.

In order to achieve hardening under the best conditions, two furnaces are recommended for the purpose—viz., a natural-draught furnace, in which the tool is heated-up to a matter of 900° C. or thereabout, and rapidly finished in a second furnace, which is held at a temperature of about 1300° C. In this way the tool is thoroughly annealed before subjecting it to the higher temperature furnace; and as the completion of the heating operation to the required temperature is very rapidly achieved in the second furnace, damage to the tool—viz., decarburization of its surface—is obviated.

Some high-speed furnaces are made in twin form—the lower chamber at a high temperature, the upper chamber at a lower temperature for preheating. But the two furnaces for high speed, as before described, are preferable, because the annealing operation with the lower temperature furnace can be better and more regularly carried out, while the finishing operation in a single-oven furnace is better, because this oven can be so adjusted as to exclude the entrance of any cold air. In fact, the flue of this furnace may be operated through the working door; and under such conditions all air is expelled from the working chamber of the furnace.

For hardening planers—another tool of which noses only have to be hardened—a small furnace of the twin form is quite satisfactory. The preheating chamber is above the finishing chamber. This little furnace will heat up to 1300° or 1400° C. in about twenty minutes, starting from cold.

Copper, brass, and other alloy metals are, of course, largely in demand for the manufacture of munitions—viz., cartridge cases, shell fuses, &c., &c.—and a good deal of extruded metal is used for the production of fuses. Brass or copper billets are heated-up in a gas-furnace prior to being placed in the press. The ingots, having a round section, are charged in the cooler end of the furnace, and work down gradually to the hot end, whence they are withdrawn one by one.

NEW SOUTH WALES AND QUEENSLAND GAS INSTITUTE.

Presidential Address of Mr. T. O. Morland, of the North Shore (Sydney) Gas-Works.

The First Annual General Meeting of the New South Wales and Queensland Gas Institute, was [as recorded on p. 596 of the "JOURNAL" for Dec. 14] held in Sydney, on Oct. 26, when Mr. T. O. MORLAND, the Manager of the North Shore (Sydney) Gas Company, the President, delivered the following Inaugural Address.

It is hardly necessary for me to say anything to-day in support of our action in founding the Institute. The fact that so many kindred Associations exist throughout the world, all of them doing useful work, is quite sufficient to justify us in our action. But I think it is desirable at this, our first annual meeting, to briefly put on record the present position of the industry, and its rate of progress in the two States of the Commonwealth from which our membership is drawn.

GROWTH IN NEW SOUTH WALES AND QUEENSLAND.

The most reliable statistics available show that during the last eight years there has been a steady growth in the number and capacity of the gas-works erected, and in the number of consumers receiving gas from them. I find that in New South Wales in 1907 there were 35 works, 16 of them owned by companies, one by Government, and 19 by municipalities. The output of gas was 2,777,936,000 cubic feet, and the number of consumers 100,542. The average output per consumer was 27,579 cubic feet.

In 1914 there were in New South Wales 45 works—an increase of ten—23 of them being the property of companies, one was owned by Government, and 21 by municipalities. The output of gas had increased to 4,674,850,000 cubic feet, equal to a gain of 68·5 per cent., and the number of consumers to 152,872, equal to 52·03 per cent.; while the average output per consumer was 30,580 cubic feet.

In Queensland there were in 1907 fifteen works, all owned by companies. The output of gas was 372,058,000 cubic feet; the number of consumers was 13,427; and the output per consumer was 27,709 cubic feet. In 1914 the number of works was sixteen, an increase of one only; but the output had grown to 745,530,000 cubic feet, equal to 100·3 per cent. increase, and the number of consumers to 27,564, equal to 105·2 per cent. The output per consumer averaged 27,047 cubic feet, a slight decrease when compared with 1907.

These figures show that the gas industry, in spite of the competition it has to encounter, is not decaying, as some think, but on the contrary is prospering. It flourishes not only in our part of the world; for in Britain and in her other Colonies and Possessions the gas industry is in an equally satisfactory condition. At no time in its history has its importance to the Empire been more strikingly exemplified than at the present; for without gas and some of the bye-products of coal, we should not possess in sufficient quantity the high explosives now so urgently needed for our defence.

COAL.

At a meeting of persons interested in making and distributing gas, coal is a subject which must occupy a prominent place in their thoughts. Fortunately for New South Wales, the great coal-fields which find the outlet for their products at Newcastle furnish an article which can be equalled in few parts of the world. Unfortunately, however, in Australia, as in many other countries, the business of hewing coal is one that is subject to many interruptions, owing to labour disputes. A general strike, during which almost the whole of the supply of coal in this State was shut off for eighteen weeks, occurred a few years ago; and other strikes of a more or less local character are not infrequent. Managers of gas-works should therefore make such provision as will enable them to tide-over periods when suitable coal is either unobtainable or obtainable only at a greatly increased cost.

The North Shore Gas Company keep, in addition to the coal delivered into the stores, a reserve stock of large coal in the yard; and though this coal is not under cover, I have no reason to believe that the exposure has caused any serious deterioration in its gas-yielding properties. The cost of keeping locked-up the capital which the coal represents is not insignificant; but when the inevitable strike comes, the expenditure is well repaid.

Like most other articles used in gas-works, coal has greatly risen in price; and the present labour unrest makes a further rise appear not improbable. We are now paying about 50 per cent. more for coal than we paid eight years ago. Labour, also, is more expensive; and though labour-saving appliances have been installed in the works, the cost of making and distributing gas has risen during this time by about 50 per cent.

NEUTRAL BAY WORKS.

At these works, part of the coal is carbonized in horizontal retorts, some of which are hand-charged and drawn, others being charged and discharged by means of a De Brouwer complete stoker. The bulk of the coal is, however, carbonized in inclined retorts. We have twenty beds of the latter, with seven retorts per bed. The furnaces are of the regenerative type. A De Brouwer hot-coke conveyor and an elevator are used in connection with the inclines. By this means, the coke is removed from the retort-house and deposited in bins in the yard. From these it is loaded into bags, or, if required, into carts in bulk.

A special feature of the coal-store adjoining the inclined retort-house is the height at which it has been built, in relation to the retorts. The inclines have been erected at the foot of a cliff rising about 50 feet above the ground-floor level. On this cliff, the coal-store has been built. Coal is delivered alongside the works jetty, by water carriage. It is discharged from the ships in baskets, and is afterwards taken to store by means of trucks and push-plate conveyors, passing through coal-breakers *en route*. It can also be weighed, if desired. Under the store, subways and shoots have been constructed. Through the latter the coal required for the retorts is drawn from the bottom of the store into trucks, and removed to the retort feeding hoppers, into which it is easily tipped. This peculiarity in the design of the store enables a larger stock of broken coal to be kept in it than would be prudent if there were no openings in the bottom. By withdrawing coal daily from each shoot in rotation, the temperature of the mass is ascertained; and if any portion of it is found to have heated unduly, this can be speedily removed to the feeding hoppers.

Chiefly with the object of profitably disposing of our coke, we have installed a carburetted water-gas plant capable of making 500,000 cubic feet daily. During the late strike at some of the Maitland coal mines—entered upon for the purpose of bringing about the abolition of the afternoon shift—we found this plant particularly useful. The mine from which we now obtain our coal was one of those affected, and remained closed for about ten months. When the strike began, we fortunately had a large stock of coke in the yard; and with the aid of this, and a quantity of oil, we were able to keep up the supply of gas without the loss which otherwise we should have sustained. The coal gas and the carburetted water gas mix before passing through the exhausters to the condensers.

NAPHTHALENE AND REVERSIBLE CONDENSERS.

These latter are of the reversible current slow-speed type. They are air-cooled, but protected from the sun's rays by a louvred shade. For several years prior to the erection of the first reversible condenser, we were receiving numerous complaints of stoppages in the service pipes, due to deposits of naphthalene. Though the quantity of gas sent out at that time was only about one-sixth of the present output, consumers' complaints from this cause sometimes amounted to over 200 per week. In the works, we were in a worse plight than outside; for the connections leading to the purifiers, the station-meter, and the gasholder were at times almost choked with naphthalene, which had to be removed from them fortnightly.

With the object of finding a remedy, I searched through all the available literature on the subject, and made preparations for the introduction of a kerosene vaporizing arrangement similar to that first used by Messrs. Botley, at Hastings. About the beginning of 1902, I read of Mr. Carpenter's experience with a reversible condenser at the Bankside works of the South Metropolitan Gas Company. I determined to instal one constructed on this principle, in the hope that it would afford us some relief. It was erected in 1903, and was a complete success, for naphthalene gradually disappeared from the works, as well as from the consumers' services and meters.

The condenser is made of cast iron, and consists of a number of lengths of 18-inch by 12-inch branch pipes bolted together, and laid so that the branches point upwards. There are four rows of pipes. Into each of the branches a double length of 12-inch pipe is fixed. These 12-inch pipes are connected at the upper end by almost similar branch pipes to those at the bottom, but made with spigot ends, so as to fit into the sockets of the 12-inch vertical pipes. The first and second rows of pipes are joined at the top by a breeches-pipe; the third and fourth being similarly connected. The inlet is provided with a four-way valve, and the course of the entering gas can be diverted as desired into either side of the condenser.

The gas is first carried to the top, and passes downward through two rows of pipes, then upward through the remaining two rows. Water can be used on the condenser, if desired; but we have so far found cooling by this method unnecessary. The temperature of the atmosphere has hitherto, if the apparatus is not overworked, been sufficient to produce satisfactory results. When the condenser is in use, any naphthalene which the gas may contain is lodged in the pipes through which it rises; and when the current is reversed, the hot hydrocarbon vapours dissolve and carry with them to the tar-tank any naphthalene adhering to the sides of the condenser. The current is reversed twice weekly.

When this condenser was erected, its cooling area, inclusive of the pipes between the inlet and the retort-house, was about 30 square feet per 1000 cubic feet of gas made per 24 hours. But with the increased output of gas, the proportion was gradually diminished; and during the winter of 1911, when the cooling area was 10 square feet per 1000 cubic feet per day, we again noticed deposits of naphthalene in the works—particularly on the purifier covers and on the oxide of iron in the boxes, though not to the same extent as in 1902. We therefore determined to erect an additional condenser of similar design, though we did not antici-

pate that the conditions existing then were contributing to the trouble which afterwards eventuated.

About the beginning of 1911 a few stoppages in the service-pipes were again reported. At Christmas we had a spell of particularly hot weather; the thermometer registering in the shade sometimes over 100° Fahr. The number of complaints of poor supply increased rapidly, until on one day—Jan. 8, 1912—they amounted to 109. Naphthalene was found in the services; but by far the greater number of stoppages were due to the spouts of the meters becoming blocked with it. At this time the additional condenser of which I have spoken was nearing completion; and we were able to bring it into use in February, 1912. During the following winter, our condensing area per 1000 cubic feet per day was 17 square feet. I am pleased to be able to tell you that we have enjoyed since then a period of freedom from this most troublesome bye-product.

As a result of my experience, I have arrived at the conclusion that, if coal is carbonized in horizontal or inclined retorts at the temperatures now employed, 10 square feet per 1000 cubic feet of gas per 24 hours is an insufficient area for atmospheric condensing. I think that from 12 to 15 square feet per 1000 cubic feet per day should be allowed, and that the condenser should be so arranged that the current of gas can be reversed. I am satisfied that the naphthalene which gives so much trouble in the warm months of the year is made and deposited in the mains during the winter. When the temperature of the summer gas is sufficiently raised, this naphthalene is taken up by it and carried forward to the services and meters, where it is again deposited.

I estimate that it costs 2s. for labour in attending to every complaint caused by naphthalene, and that another 2s. is lost owing to the diminished consumption of gas between the time when the obstruction began to interfere with the gas supply and its removal. The loss to gas companies caused by naphthalene deposits, and the inconvenience and annoyance to consumers, are so great that every effort should be made to abate this nuisance.

PURIFIERS.

Our purifiers are of the dry-lute kind. The joints between the covers and the boxes are made with hemp gaskets soaked in a hot mixture of white lead and tallow. The grids on the lower tier of the T-steel bearers are of the ordinary pattern; but the others consist of single wooden bars ▽ shaped in section, and placed at distances of about 7 inches apart centre to centre on the remaining bearers. We find that, if the oxide is supported in this way, it is kept sufficiently open to enable the boxes to be filled in one layer to within 9 inches of the roof, without causing undue back-pressure. The work of emptying them is easy, when compared with that required in purifiers fitted with grids of the hurdle type. Replacements of the V-shaped bars are not so frequent, but when required are easily and cheaply made.

RESIDUALS.

The disposal of residuals is a subject requiring constant attention. When the production is in excess of the demand, coke (a bulky bye-product) causes inconvenience in the works, and great expense in stacking. Our carburetted water-gas plant has relieved us, to a large extent, of this difficulty; and we are now able to dispose of our surplus coke almost as soon as it is made. Our ammoniacal liquor is sold to a company who manufacture anhydrous ammonia from it. Formerly we converted our gas liquor into sulphate of ammonia on the works. Tar has, of late, been in good demand in Australia, where in summer the heat drys up and makes the macadam roads easily broken by the traffic. Nothing keeps them in such good condition as a few coats of coal tar, sprinkled when hot over the surface; for the hotter the weather, the more elastic the road becomes. Some of the municipalities on our side of the harbour find that by adopting this practice they save large amounts yearly.

COMPETITION AND ELECTRICITY.

As you probably know, we shall soon have opposition from the Sydney City Council, who are now erecting poles and wires for lighting with electricity the four municipalities on the North Shore. We shall probably lose some customers who light by gas, or who would have done so if electricity were not available; but I do not anticipate that electricity will very materially reduce the volume of our business. A short time ago a customer who had installed the electric light in his residence complained that, though gas was not now used by him for lighting to the same extent as formerly, his gas bill was in excess of the corresponding quarter of the previous year. I found this statement to be correct. In the New South Wales "Industrial Gazette" for September, I learn that a gas consumer lodged a similar complaint with the Government gas examiner; and this officer, after investigation, reported that the amount of gas charged for had been consumed. The fact is that the quantity of gas used in domestic lighting is small when compared with that consumed in cooking and heating. The comparatively small cost of lighting by gas was responsible for these complaints.

Electricity has the disadvantage that, when compared with gas as an illuminant, it costs nearly twice as much, and when used for cooking or heating three-and-a-half times as much. In arriving at these results, I have taken the prices now ruling in Sydney for electricity and gas respectively.

SHOW-ROOM.

At North Shore we are prepared to meet the coming competition. In the offices recently erected, we have a show-room which faces the street, where we exhibit and sell all the most approved appliances for lighting, heating, and cooking. The room is brilliantly illuminated from dusk to 10 p.m. every evening by inverted incandescent lamps hung outside and lit and extinguished by clockwork. On the first floor of our office there is now being constructed a model dwelling, planned by our Secretary. This comprises all the necessary rooms, from the laundry to the drawing-room, and is fitted up with gas heating, cooking, and lighting appliances of the most up to-date kind. In connection with this exhibition, we have recently engaged a lady lecturer; and when the arrangements are complete, we purpose giving lectures and demonstrations in cooking.

OYSTER COVE WORKS.

At Oyster Cove, where additional works are now being erected by the North Shore Gas Company, many natural difficulties have had to be overcome. Considerable sums have been spent in reclamation, in diverting a water-course running through the property, in excavating and filling in, and in road making. We hope, however, to effect some economies there by improved methods of handling material, and in carbonizing. At our new works, we purpose discharging the colliers by electric cranes and grabs, instead of by baskets or buckets. The cranes will deliver the coal into breakers, through which it will pass to a gravity bucket conveyor and elevator. It will be raised by the latter to a height of 90 feet, and deposited in the coal-store. As at the Neutral Bay works, the coal will be drawn from the store through openings in the bottom. But the Oyster Cove store will be twice the width of that at Neutral Bay—viz., 100 feet.

VERTICAL RETORTS.

The retorts are Glover-West continuous verticals. The bench will contain ten settings of eights. The coke from the retorts will discharge into a De Brouwer hot-coke conveyor, by which, and by an elevator, it will be removed to, and deposited in, bins at the end of the retort-house. There are two bins; one to receive the coke for the furnaces, the other the coke for sale.

A carburetted water-gas plant capable of producing 500,000 cubic feet per day has been erected. The coke for this will be delivered by the elevator into trucks; and after crossing a bridge 40 feet above the yard level, it will be delivered into the feed-hopper in the carburetted water-gas house. Coke which cannot be stored in the bins will be removed by a telpher and stacked in the yard. The telpher can also be employed in storing, in the open, a reserve stock of coal. The section of the works now being erected will have a capacity of 2¾ million cubic feet per day; but there is room on the site for a plant able to produce nearly 7½ million cubic feet per day.

INDUSTRIAL LEGISLATION.

The industrial laws under which we are now working, and the conditions which have come into existence since they were enacted, bear very hardly on most employers of labour. But the gas industry is, in my opinion, more adversely affected by them than any other. In the event of a dispute with our men, we cannot close our works without causing great inconvenience to the large number of people who now require gas for domestic purposes. A strike at the gas-works also generally brings about a cessation of work in many factories where gas is used either to produce power or in some manufacturing process.

Industrial agreements may be entered into with the employees as to the quantity of work to be done, and Wages Boards may determine the wage to be paid; but none of these has so far been sufficient to ensure more than short periods of peace. If the agreement does not suit, it is broken. If the wage is not thought to be enough, more is asked for, and if not granted a strike is threatened. In addition to these serious troubles, disputes of a minor character are of almost daily occurrence. Conferences with the union secretary and attendances at meetings of Wages Boards are now becoming so numerous that in works employing (say) 1000 men, the time of an officer could be fully occupied in dealing with them, or in getting ready to deal with others which he knows will shortly arise.

Parliament has, perhaps, not improperly placed certain restrictions on gas companies. Could it not also impose on the employees conditions which would ensure the protection that the public so much need? This is a matter that has, so far, not apparently engaged the attention of our Legislature, but which I feel certain must eventually force itself upon them.

TWO-AND-A-HALF YEARS' WORKING EXPERIENCE WITH CONTINUOUS VERTICALS.

By J. Mackenzie, of Newcastle (N.S.W.).

[A Paper read before the New South Wales and Queensland Gas Institute, Oct. 26, 1915.]

At the request of the President, I have pleasure in contributing a few notes which may prove of general interest to members, and, I hope, helpful to some who may be in the position of having to decide the important question of extensions to their carbonizing plant. My Company were the first in Australia to bring into use an installation of continuous vertical retorts; and we therefore had the honour of first working through the difficulties which may

be said to always follow the adoption of an entirely new system such as this.

Our system is the Glover-West. We have four double benches of eight retorts each, a total of 32 retorts. Each bench is heated by a producer, whose gas-outlet can be made to heat eight retorts or only four retorts, as required. This is found an economical arrangement as regards fuel, when not more than four retorts in a particular bench are needed.

The coal is received by rail in hopper-waggons on the Company's gravity sidings, where they are moved as required over a large underground hopper, and the doors struck. The coal gravitates to a breaker, and is then taken by a bucket elevator either into the coal-store or direct up to the continuous hoppers which are fixed immediately over the retorts. A lift is provided for raising the coke in hopper-barrows to the producer floor for feeding the producers. The coke falls from the retorts, and is removed by a drag-bar conveyor moving in a trough and fixed in the floor directly under the retorts. The coke is discharged from the drag-bar at the end of the retort-house into a bucket elevator, which carries it up to a set of three overhead hoppers, where it is screened and classified.

For the whole of the operations, which embrace the journey of the raw coal from the waggon through the retorts till the coke is dropped into sacks from the coke-hoppers, no man-handling is required beyond opening a door or moving a lever—electric power being exclusively used—direct current at 220 volts. The motors are all totally enclosed and dust-proof.

The success or otherwise of the continuous vertical system very largely depends upon the unhindered and unimpeded action of gravity, from the time the raw coal enters the top of the retort until it is extracted as coke into the chamber at the bottom; for should this law be interfered with in any particular retort, gas making will cease in time in that retort until the trouble is removed. This trouble is called "hanging-up," and may emanate from two causes—namely, excessive swelling of the coal in the retort, or irregular growth of carbon in the retort.

In the early days of working, we had trouble from the first cause when using Borehole coal. This coal, when put into the retort, expands greatly; and the coke at times packs so densely at the bottom of the retort that the extractor cannot break it off, but works a face on it, and so the regular descent of the charge is arrested. Apart from frequent stoppages, the carbonizing of a coal like this by itself is necessarily slow, and consequently the output of the retorts is less than it would be if the uninterrupted passage of the coal through the retorts was going on freely. By mixing a small proportion of Maitland coal with the Borehole, the former appears to keep the coke in the retort in a more loose state; and this has been found to work very satisfactorily. The second cause of "hanging-up" is due to a retort having run too long before the carbon is stripped off; and irregular patches of carbon obviously hinder the free passage of the charge through the retort. The remedy for this is not to wait until the trouble actually occurs, but to anticipate it. It is best to have a table drawn up, showing the number of days the retorts have run and when each retort is due for cleaning, so that each retort comes off, is cleaned, and put on again automatically, as it were.

Scurfing is carried out by first emptying the retort and opening the sight-hole on the coke-chamber, and removing the ball at the top of the retort. A strong upward current of air is thus set up, which soon loosens and burns off the carbon, which drops off, or may be easily stripped off with long light bars from above. It is noticeable that there is proportionately less carbon removed from verticals than horizontals, which, I think, is accounted for by so much of it being actually burnt-off by the strong current of air mentioned. Not the least important part of scurfing is to chip off all carbonaceous matter from the inside of the coke-chamber, so that the worm will work freely at least until the retort is again due for cleaning.

The heating of the retorts is a most important factor tending to successful working; and the author has found it advantageous to train a man specially to attend to this work, who understands the principles of combustion, the adjustments of primary and secondary air supplies, and the general "why and wherefore" of maintaining regular and constant heats. This man spends about an hour each morning examining the flues and heats and adjusting, after which he goes on to other work. It pays to fire-clay wash the fronts of the settings periodically, to prevent stray air getting drawn into the flues. It is also advantageous to now and again test the gases leaving the main flues, to see that there is no waste going on. The author has installed a "CO_2 Recorder," which can be easily connected to any of the four main exit-flues as desired. This machine, along with the recording calorimeter, is fixed in a dust-proof case in the retort-house, and under the observation of the operators.

A matter which gave considerable trouble in the early days of working was a growth of tough, sticky clinker up the sides of the producers and beyond the reach of bars from below. About once a fortnight the clinker got so bad that it was necessary to allow the fire to get low down in the producer. Then the clinker was chipped off by means of bars through the charging-door below. This operation took up a considerable time, and was very hot, arduous work. It can be well understood that it did not do the settings any good. Not only was producer gas stopped entirely while the cleaning was going on, but cold air was drawn in, and the heats rapidly fell back until the fire was rekindled and the producer again brought into action. This trouble has been largely overcome by injecting steam all around and under the fire-bars along with the primary air. The steam has the effect of minimizing the upward growth of clinker, and renders it rotten and friable; and it can be easily broken off by bars from below.

Another matter which has given, and is still giving, trouble is a pitchy deposit in the collecting main, which, if not regularly cleaned out, would soon entirely block-up the main. The author has traced this trouble back to the overheating of the crude gas immediately on issuing from the retort, and is of opinion that it cannot be entirely overcome, having regard to the efficient heating of the tops of the retorts, except by considerable alteration to the top mouthpiece and off-take pipe. The trouble may be minimized, however, by preventing radiation in every way possible from the brickwork to the mouthpiece.

Though these retorts are described as continuous, the production of gas is largely in intermittent rushes. At each turn of the extractor-worm, which causes a quantity of coke to leave the retort proper, and a corresponding quantity of coal to take its place, there is a sudden evolution of gas; and as this happens simultaneously on all the retorts in action on one side of the retort-house, the pressure backs-up rapidly on the retort-house governor, and a quick response is requisite from this apparatus. The author has found it necessary to maintain a pull of 20-10ths on the inlet side of the governor, in order that it may be quicker to respond to these sudden rushes of gas. A different form of valve on the governor, however, appears to be required, in order to get perfect results under vertical retort conditions.

As regards the labour required for operating this installation, two men on each shift do the work up to the full number of 32 retorts which includes starting and stopping the necessary motors, discharging coke from the retorts to the conveyors, filling the producers with coke, pricking-down coal from around the tops of the retorts and charging the intermediate hoppers, and pricking the producer-fires and cleaning out the ashpans. Any retorts "hung-up" have also to be got to work by these men.

The fires run 48 hours before cleaning, and one is cleaned every other day; and this and scurfing are performed by other men. One man is employed from four to six hours each day six days a week removing pitch from the collecting main. A greaser is also employed every day to attend to the lubrication of the extractors, motors, and the coal and coke handling plant.

To sum up the experience gained in the working of these retorts, the author can testify to the immense improvement over horizontal retorts with the old-fashioned direct fires, which this system replaced. The advantages in our case may be briefly stated as: (1) Large saving in labour. (2) Increased yield of gas. (3) Great improvement in working conditions for the men.

Those who are considering the adoption of these retorts, however, the author would especially advise to carefully weigh with these advantages the following: (1) The coke is different. It is harder, and has all volatile matter removed. (2) The tar is much thinner, and contains more light oil. These are important considerations, where a good steady sale for coke and tar have been established under horizontal conditions, so to speak. As soon as the same residuals, but made under vertical conditions, come to be used by the same people, complaints will probably ensue. If the coke, for example, is sold mostly for domestic use, it will probably be found that it requires more draught than formerly, or that a different type of grate is required to properly consume it. The author also has found that the tar from verticals, before it is at all suitable for road-making purposes, must be denuded of its water and light oils.

In large units always fully employed the saving in labour is very considerable, as has already been pointed out, and outweighs any disadvantages in the changed conditions of coke and tar. When, however, the unit is less than one million feet per day, the saving in labour decreases proportionately, as the same number of men who make half-a-million feet can also make twice the quantity. In other words, and assuming that one man's work per shift is limited to sixteen retorts heated by two fires, this would produce on an average 480,000 cubic feet per day. When more gas is required beyond this quantity, no matter how small, it will be necessary to employ one man extra on each shift; so that their work and the quantity of gas they produce will be quite out of all proportion to what the other men are doing up to a certain point. These are important matters to consider where the unit is intended to be a small one, and not always fully employed.

In order to get over this disproportion in having to employ extra men to make a relatively small quantity of gas, the author has installed a carburetted water-gas plant, which it is intended to bring into use only when immediately required, and keep the number of retorts at work constantly, and at nearly the maximum number the men can work. This, it is hoped, will obviate the necessity of having to keep men who are not fully employed all day, though fully paid for the day.

As regards the appearance of the retorts to-day, all the author can say is that they still look in excellent condition; but it is impossible to tell yet what their life will reach to—certainly much longer than the old horizontals. The only important repairs so far found necessary has been the relining of one producer just above the fire-bars.

American Gas Institute Meeting for 1916.—It has been decided that this year's meeting of the American Gas Institute shall be held in Chicago on Oct. 17, 18, and 19.

SWISS TESTS OF GAS-FIRES.

By Dr. E. Ott, of Zürich.

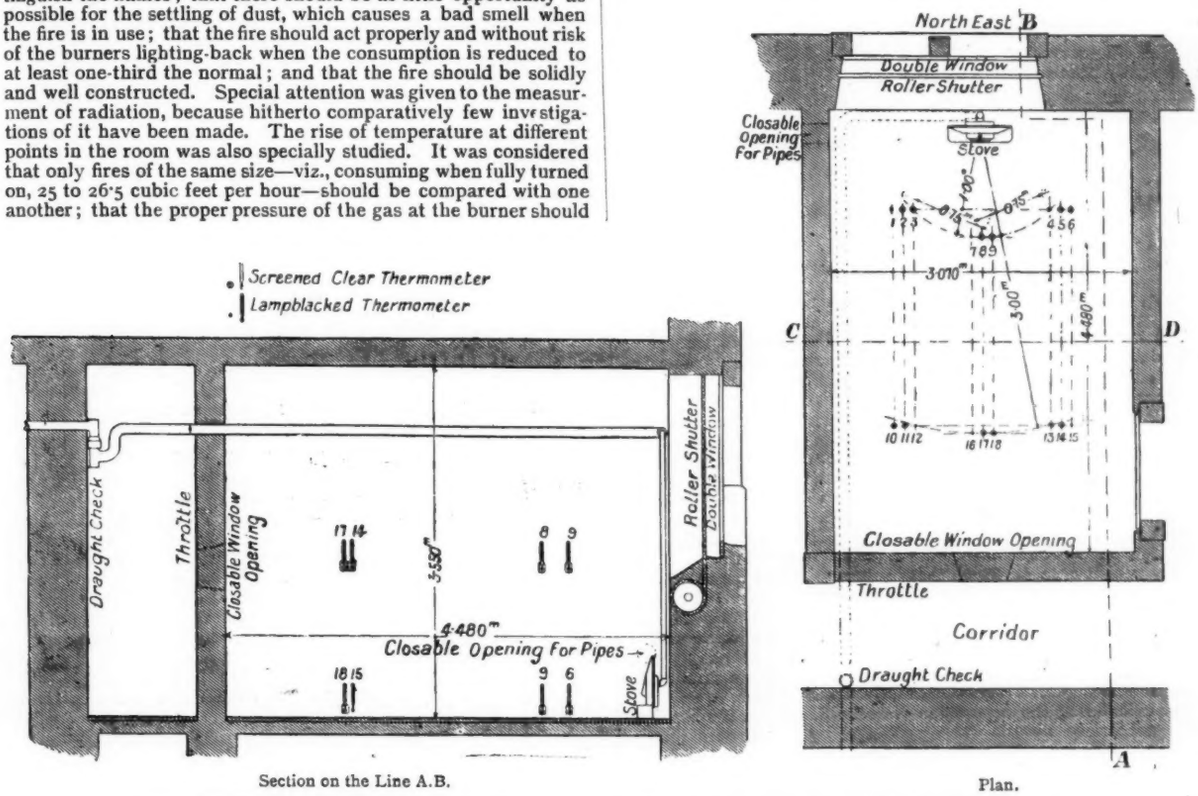
Contributed by Dr. E. Ott to the "Journal für Gasbeleuchtung" of Nov. 6 and 13, was an account of investigations carried out by him in the laboratory at the Schlieren works of the Zürich gas undertaking, on the efficiency of different types of gas-fires. The following is an abbreviated translation of the contents of Dr. Ott's articles.

The investigation extends to gas-heating apparatus which acts mainly by convection, as well as that which acts mainly by radiation, because both types have some special advantages which are rightly appreciated by the public. The hygienic aspect of the question whether heating by convection is preferable to heating by radiation is not discussed by the author, as he regards it as a question to be settled by authorities on hygiene. The satisfactory character of a fire depends primarily on the heating efficiency—*i.e.*, that while the calls upon it vary, it furnishes as much heat as possible to the room which is being warmed, and allows as little as possible to escape with the chimney gases. Any deficiency it may have in this respect, however, may be compensated by better and more rapid utilization of the rest of the heat. But there are also other considerations in judging the satisfactory character of a gas-fire, among which may be mentioned that, in normal working, it should allow no products of combustion to escape into the room; that down-draught in the chimney should not damp or extinguish the flames; that there should be as little opportunity as possible for the settling of dust, which causes a bad smell when the fire is in use; that the fire should act properly and without risk of the burners lighting-back when the consumption is reduced to at least one-third the normal; and that the fire should be solidly and well constructed. Special attention was given to the measurment of radiation, because hitherto comparatively few investigations of it have been made. The rise of temperature at different points in the room was also specially studied. It was considered that only fires of the same size—viz., consuming when fully turned on, 25 to 26·5 cubic feet per hour—should be compared with one another; that the proper pressure of the gas at the burner should be 16·10ths to 20·10ths; and that the middle of the flames should in all cases be about 12 inches from the floor.

The Experimental Room.

The room used for the investigations was in the basement of the laboratory. On three sides, it had adjacent rooms; on the fourth, or northern, side only the upper half of the wall was exposed. On this side external influences were excluded by means of puttied-in double windows and an iron roller shutter. Openings in the wall for the door, and for admitting pipes, and the small window, were closed as carefully as possible, so as to render the room reasonably independent of the influences of the weather. Moreover, the investigations of distribution of temperature and of vitiation of the air were made on days when there was little wind. The position and the shape of the room, which was of about 1765 cubic feet capacity, are shown in fig. 1.

It was at first intended to make the temperature readings from outside; but it was found more convenient, in view of the distribution of the thermometers, to read them in the room itself. An observer, therefore, remained in the room while it was warmed up by the fire at full consumption, moving about as little as possible. He made the first set of temperature readings and, in addition, attended to the reduction of the rate of consumption when the desired room temperature had been attained. He also took samples of the air. While this method of taking the temperatures possibly did not give absolutely accurate results, it was permissible for comparative purposes, as the same method of working was followed in all cases. Practically the same readings were



[All dimensions in metres—1 metre = 39·37 inches.

Fig. 1.—EXPERIMENTAL ROOM.

obtained on repetition. When efficiency and radiation measurements only were being made, the door and shutter were opened.

Efficiency Testing.

The efficiency is well known to be greatly affected by the chimney draught; and in order to test the fires thoroughly for escape of products of combustion, a draught of only 0·04 tenth of an inch of water was chosen for the particular tests. With proper construction of the fire this draught should suffice to remove the whole of the products of combustion. In order to maintain the draught at this same figure for comparative purposes, the connection of the fire to the chimney became of importance, as many fires otherwise would not have obtained the desired draught. The immediate removal of the principal current of flue gases was necessary in order that escape of products of combustion might be traced through the detection of carbonic acid. Though the use of the flue-pipe gave somewhat more unfavourable results, they corresponded more nearly with those obtained in practice than if the pipe had been dispensed with. In order to ascertain the effect of flue draught on the efficiency, other tests were made with a draught of 0·12 tenth of an inch. The draught was controlled by means of a throttling flap and a draught check situated outside the experimental room. In an adjacent room readings of the draught were made on a micro-pressure-gauge filled with ethyl alcohol. It admitted of readings being made with precision to 0·004 inch of water. The pressure-gauge was of a differential type—both limbs being connected by glass tubes (one to the flue-vent and the other to the front of the stove) with the experimental room, but having in the connections three-way taps, by means of which the pressure in either limb could be brought to the prevailing atmospheric pressure.

The efficiency was calculated by the following simple and sufficiently precise formula drawn up by Dr. K. Bunte:

$$\text{Efficiency percentage} = 100 - 100 \times \frac{a}{b} \times \frac{c\,(t - t)}{H_n}, \text{ in which}$$

a = the volume of carbonic acid produced by the combustion of one volume of gas;
b = the percentage of carbonic acid in the hot humid flue gases;
c = the specific heat of the hot humid flue gases;
t_a = the temperature of the escaping flue gases;
t_z = the temperature in the middle of the experimental room;
H_n = the net calorific power of the gas in calories per cubic metre at 0° C. and 760 mm.

The percentage of carbonic acid in the flue gases was generally only determined directly—viz., about 12 inches from the gas-fire—as a number of samples taken at the exit from the room gave practically the same results. The flue gases for testing were sucked into an adjoining room and analyzed with an Orsat apparatus. On the other hand, the temperature of the flue gases decreases very rapidly as the distance from the fire increases. Therefore it was observed both at the flue vent from the fire and at the flue exit from the room—viz., about 10 feet from the floor. Ordinary chemical thermometers were used. For ordinary calculations it is sufficient to use a mean value for the carbonic acid produced on combustion and the calorific power of the gas; but in the present case, in which these values changed considerably, account was taken of the changes in order to increase the degree of exactness of the investigations. The carbonic acid produced on combustion was determined for the extreme calorific values by the combustion of 100 c.c. of the gas over copper oxide; and the calorific power was ascertained by means of an automatic Junkers calorimeter, which was exactly standardized.

For calculating the proportion of carbonic acid in the hot flue gases containing all the water produced by combustion in the form of vapour, it was assumed that about two volumes of aqueous vapour are formed with one volume of carbonic acid. The proportions of carbonic acid stated in the sequel are not the direct readings of the Orsat apparatus, but refer to the hot humid flue gases. The mean specific heat of the latter was assumed to be 0·32. Fires provided with an anti-back-draught device were tested both with and without it, in order to ascertain its effect on their efficiency. The efficiency of all the fires was ascertained both when burning at the maximum normal rate of consumption and at about half the rate.

Radiation.

The radiation was measured by means of a water calorimeter on the principle of that described by J. C. Clark in the "Journal of Gas Lighting" in 1910 [Vol. CXX.; p. 239], as subsequently adapted and used in the Laboratory of the United Gas Improvement Company at Philadelphia [*vide* "Progressive Age" of Dec. 16, 1912]. Some modification of it was done. The measuring instrument consists of a casing made of copper plate 0·03 to 0·035 inch in thickness, having the shape of an arch 2 metres (79·7 inches) in span, bounded by two meridians at a distance of 20°. The inner surface of this arch is exactly one-eighteenth of the upper surface of a sphere 2 metres in diameter. The greatest width of the apparatus, which takes the curve of a sphere, is 349 mm. (13·8 inches). The two surfaces of the case are 3 mm. (0·12 inch) apart. The narrow space thus provided holds only a little water, and hence a condition of equilibrium is attained after a few minutes. In order to ensure thorough mixing of the water, the space is provided with baffles, which are only lightly attached to the copper plates, and hence allow some water to take the shortest passage, and thus any dead angle spaces are avoided. The inner surface of the vessel, which faces the stove, is blackened. The back of the vessel is polished, and enveloped by another polished copper plate, 0·024 inch thick, which forms an air jacket. This third plate is not attached to the others by conducting material, and hence does not take up heat from them.

The whole vessel can be brought to any desired position by means of an arc lamp suspending cord and pulley. The water enters at both ends, and flows out in the middle at the top. Its increase of temperature is measured by thermometers graduated to 1-10th of a degree Centigrade. A constant head overflow ensures a uniform inflow of water, so that practically the same quantities of water were used for all the tests. The temperature of the air was determined by three thermometers attached to the back of the apparatus, and the temperature of the inflowing water was regulated so that the mean of the three thermometer readings agreed approximately with the mean of the inlet and outlet water temperatures. This was easily effected by regulating the air temperature by opening the door and window ventilators. Care was taken, however, to avoid draught; the smoke of fumigating pastilles rose vertically and not towards the calorimeter. The effect of convection on the measurements was excluded as far as possible, and the calorimeter gives records substantially only of the radiation of the fire. The apparatus is shown in fig. 2.

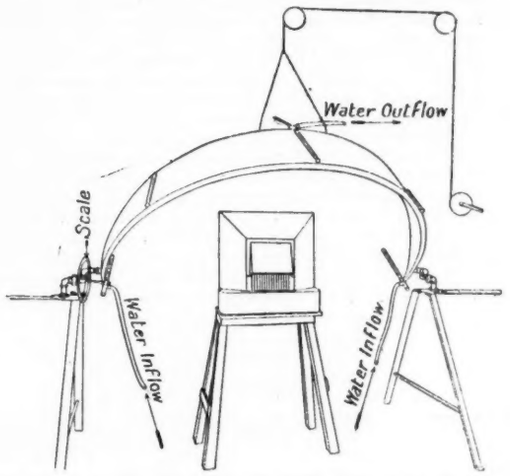


Fig. 2.—Radiation Calorimeter for Domestic Gas-Stoves.

This method occupies only half the time of that adopted by the [? Carlsruhe] Institute, by which radiation and convection are determined together, and then the effect of convection alone by cutting off the radiation by means of a copper screen. The method adopted at Zürich also appears to be more exact, as it is extremely probable that the screen cuts off more or less of the convection as well as the radiation. The radiation at the upper 30° cannot be measured by the new method, owing to the upward convection currents, which is a disadvantage of it in comparison with the bolometric method. But on the other hand, the latter method is more complicated, and is probably inexact for other angles. Moreover, this upward radiation is of comparatively little importance, both on account of its amount and direction.

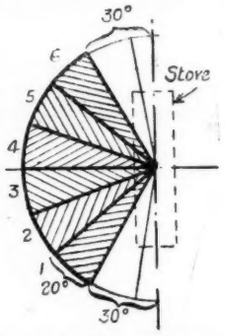


Fig. 3.—Angles at which Radiation was Measured.

With many fires it would probably be less than the radiation from the back of the fire, which is reflected from the wall, and which hitherto has never been properly determined. The radiation for the bottom 30° was also excluded, as it was really very small, and, owing to the interference of the base of the fire, it could only have been determined with difficulty. The radiation was therefore determined at angles of 20° in the six directions shown by shaded lines in fig. 3. At the angle marked 6, the hot air currents rising from the fire were not interfered with; for it was shown that smoke rose up vertically.

In order to obtain rises of temperature sufficient to avoid errors,

the fires were tested at full consumption. When the consumption was reduced to half, supplementary tests showed that the radiation was about in the same ratio. After conditions of equilibrium had been attained the measurement was made, extending over five minutes. It consisted of collecting the warm water flowing from the calorimeter and taking readings at intervals of a minute of all the thermometers. The rise of the temperature of the water when about 3 litres were passing in five minutes—the calorimeter holding about 2 litres—was never less than 0·2° C., and never more than 6·5°.

The heat radiated was calculated from these data in the usual way, and expressed as a percentage of the heat of the gas consumed in the same time. In order to get rid of air bubbles, it was necessary at the beginning of each test to move the calorimeter to and fro a few times. It then worked quite well, and can be recommended for comparative testings. The angles named can be all tested with it within half-a-day. The apparatus was made by a Zürich coppersmith, according to instructions. Scarcely any noticeable effect on radiation was caused by the use of the anti-down-draught devices.

Distribution of Temperature.

The distribution of temperature was ascertained by means of thermometers graduated in tenths of a degree Centigrade hung at different heights and at different distances from the fire. In order to ascertain the temperature of the air, as well as the effect of radiation on the room, some of the thermometer bulbs were protected with rolls of silver foil and others were blackened. Twelve thermometers were distributed in two circles with radii of 1 and 3 metres (39·3 and 117·9 inches), with the bulbs one-fifth of an inch from the floor. They were arranged in six pairs—one with the polished screen and one with the blackened bulb in each pair. There were also six thermometers with polished screens suspended with the bulbs, 1·5 metres (59 inches) from the floor, exactly over the middle line between each pair at the floor level. The mode of distribution is shown in fig. 1. Another unblackened thermometer was suspended in the middle of the room to ascertain the average temperature of the room.

The thermometers were read twice or thrice an hour in the closed room before each test, in order to ascertain that there was equilibrium of the temperature conditions. The fire was then lighted and kept burning at full consumption for 55 minutes, when the observer in the room quickly made temperature readings. The fire was checked to half consumption five minutes later, and a sample of air was taken from the middle of the room. The observer then left the room; and the continuous heating test, extending over three hours, started from this point. Two hours and 2 hours 55 minutes later all the temperatures were again rapidly observed, and a sample of air taken. Five minutes after the last set of observations, the fire was turned out. Temperature readings were made during the next three hours in order to ascertain the course of cooling. Air samples were also taken in order to get data on the renewal of the air. The door was left open slightly during the night, so as to bring about the state of equilibrium necessary for another test on the following day. The temperature of the outer air was observed throughout, and the weather conditions were noted. All tests were repeated twice or thrice; and the mean of concordant results has been given in the report.

The temperature distribution tests involve much more detail than the radiation measurements, and require suitable environment and quiet weather. The work done, however, shows that in future the distribution of temperature which a fire may be expected to give can be deduced with sufficient accuracy from its radiation results. With the exception of Type V. of the stoves tested, the temperature distribution tests were made without the stove being connected to the chimney, and with the throttle-valve fitted in the passage closed. The efficiency of 100 per cent. thus attained was adopted in order to exclude differences in the heat efficiencies of the fires, and thus to make the results solely dependent on the heat distributing qualities of the fire under test. Comparative experiments with chimney draught have not shown any appreciable differences. On the other hand, the radiation tests were carried out with chimney draught in order to avoid the effect of hot currents of effluent gas. But in this case also the results were stated as a percentage of the total energy applied, and not merely of energy utilized by the fire. The results were therefore brought on to the same basis. This procedure was permissible, because radiation is much less affected than room temperature by the method of removal of the flue gases. It depends to a much larger extent on the concentration of heat and the temperature thus produced of certain parts of the fire.

Hygienic Conditions.

The air from the vicinity of the fires provided with flue exits and from the middle of the room was tested for carbonic acid with a Haldane apparatus, which admits of smaller proportions of carbonic acid than 0·01 per cent. being read. It may be mentioned that the dew-plate ["Shadowgraph"] method was found insufficient, particularly for fires with burners not placed right in front. On the other hand, fumigating pastilles serve to detect any escape of flue gases. With fires in which individual heating flames are comparatively wide apart—which are objectionable on account of the uncertainty in lighting—faulty removal of the products of combustion may be detected from the smell of escaping gas when one burner is extinguished. The determination of carbonic acid, however, is the only trustworthy basis for determining the escape of flue gas.

The completeness or otherwise of combustion was checked by means of palladium chloride. In order to obtain results giving some quantitative indication of the proportion of carbonic oxide in the flue gases, the very sensitive palladium paper was not used for the purpose, because it indicates traces of carbonic oxide which are quite harmless. A dilute bright yellow solution of palladium chloride was used instead. It has been found that if about 5 litres of flue gas are passed through about 70 cc. of this solution, with frequent vigorous agitation, in the course of four hours, obvious discoloration ensues if the flue gases contain about 0·1 per cent, of carbonic oxide. Such a proportion of carbonic oxide is injurious to health, though it should be pointed out that with this proportion of carbonic oxide in the flue gases even considerable escape of them will not raise the proportion in the air of the room to 0·05 per cent., which is harmless. The heavy hydrocarbons which affect the reaction were retained by fuming sulphuric acid followed by a solution of caustic alkali to absorb any acid sprayed over.

Special importance was attached to observing whether gusts of wind interfered with the combustion, or caused the products of combustion to be expelled into the room. In making these tests, the throttle flap was quite closed and the flue gas was tested with palladium chloride for carbonic oxide. Measurements were also made of the temperature of the heated surfaces and of the air passing over them. Importance was also attached to the efforts of the makers to make the heating surfaces vertical and as readily accessible as possible, in order to prevent deposition of dust or to facilitate its removal. Finally the burner orifices should be so near one another that flame spreads over the whole when one burner is lighted. This prevents the dangerous extinction of a single flame due to initial condensation of water, which has the result that unburnt gas passes into the chimney or into the room.

(To be continued.)

SOCIETY OF CHEMICAL INDUSTRY.

Meeting of the London Section.

At a Meeting of the London Section of the Society of Chemica Industry, held at the Chemical Society's rooms, Burlington House, on the 3rd inst., under the chairmanship of Mr. A. R. Ling, F.I.C., there were five papers down for reading and discussion, as well as some exhibits of chemicals and apparatus the manufacture of which in Great Britain had only recently been undertaken. These exhibits included laboratory glassware by Messrs. Baird and Tatlock and Messrs. John Moncrieff, Limited, laboratory porcelain ware by Messrs. Doulton and Co., and some chemicals of the degree of purity required for use as analytical reagents by the British Drug Houses, Limited.

Owing to the full programme, only brief abstracts of most of the papers were read. One of the communications was on "The Viscosity of Oils in the Redwood and Ostwald Viscometers," by Messrs. C. Savill and A. W. Cox. The authors stated that the paper gave tables and graphs showing comparative results obtained for eleven different oils with the Redwood viscometer (which is the instrument in general use in this country) and the Ostwald apparatus, which gives absolute viscosities expressed in dynes per square centimetre. The graphs showed that the curves obtained for the same oil by the two methods were regular and parallel in all cases. It would therefore be possible, by plotting on a graph the results found by one of the methods for any oil, to deduce the corresponding readings by the other method.

Another paper, of which only a very brief *résumé* was given, was by Mr. R. C. Frederick, on "The Estimation of Carbon Dioxide in Air by Haldane's Apparatus." The author showed how the ordinary apparatus, the range of which is usually restricted to air containing less than 100 volumes of carbon dioxide per 10,000, could be adapted for use on samples of air containing two or three times this volume, by calibrating the capillary tube which extends upwards from the absorption pipette in such a manner that the volume between two marks on this tube corresponded exactly to 100 volumes per 10,000. By making the initial reading at the lower mark and the final reading—after absorption of the carbon dioxide—at a higher mark, it was easy to analyze with the apparatus samples of air containing more than 100 volumes of carbon dioxide per 10,000. The author also showed an arrangement for raising and lowering the mercury reservoir of the Haldane apparatus, consisting of a carrier for the reservoir connected by a cord passing over a pulley to a counterpoise, the travel of which was limited at each end by stops. This arrangement saved the labour of raising and lowering the mercury reservoir by hand, and also avoided the risk of mercury being driven over into the absorption pipette through the reservoir being raised too high, or of potash solution being drawn over into the burette through the reservoir being lowered too far. It thus made the apparatus as far as possible fool-proof. The author also mentioned that he had tried various means of stirring the water in the water-jacket, instead of blowing air warmed by passage through the lungs directly into it. He recommended the blowing of air at the temperature of the room through a vessel containing water, in order to saturate it with moisture, before passing it into the water-jacket.

Brief comments on the author's modifications were made by Dr. S. Rideal, Mr. W. J. A. Butterfield, and Mr. Jacques Abady.

HIGH-PRESSURE DISTRIBUTION.

By T. F. Waugh.

[Extracts from a Paper read before the New South Wales and Queensland Gas Institute, Oct. 26, 1915.]

Before dealing with the main subject of his paper, the author gave an outline of the growth of the Australian Gaslight Company's area, which eventually led to the general adoption of the high-pressure system as it exists to-day. He showed that gradually, owing to the rapid growth of the outlying districts, the pressure had fallen below that which was considered sufficient to give a good supply. To have remedied the trouble by means of further low-pressure mains would have meant an enormous capital expenditure, as nothing less than 18-inch mains would have carried the amount of gas required; and in many cases 24 and 30 inch mains would have had to be laid. It was therefore decided to lay comparatively small mains, carrying gas under high pressure, into these districts, and so reinforce the low-pressure system at points approaching the extremities of the affected areas. High-pressure distribution may be divided into three distinct classes: (1) Reinforcement of low-pressure supply by means of comparatively small high-pressure mains and district governors; (2) transmission to outlying gasholders; (3) direct supply to consumers by means of service-governors. Taking them in order, the following is a description of the work carried out by the Australian Gaslight Company.

Reinforcement by High-Pressure Mains and Governors.

A map of the whole area under supply was prepared, and the districts with poor pressures were marked. The mains maps were then consulted for each district in question; and the points where governors were necessary were all settled. The required high-pressure mains were then plotted, each route being gone over individually, so as to ascertain its feasibility. After this, the work of laying the mains and fixing the governors was put in hand. Generally 12-inch mains were laid. The governors were placed in brick pits in the footpath, with a manhole for access. These governors were of varying sizes, from 12 inches down to 3 inches, according to the size of the low-pressure main they were delivering gas into. We then had our supply reinforced at the points where it was required, and had also retained the original low-pressure supply. The result was that, instead of the pressure gradually dropping from a station-governor to the end of the district, we obtained pressure equal to that given by the station-governor at the extreme end of the district, and so brought our lowest pressure to a point somewhere midway between the two sources of supply. Providing this minimum pressure was not less than 20-10ths, there was no need to do anything further. If below this, all we had to do was to put in another governor at this point, and so bring the pressure up to the required amount.

A very good example of this method is the work we carried out between Gordon and Roseville. We had two 12-inch low-pressure mains supplied by the Roseville governor at Gordon running parallel for some distance. At a point some 3000 yards from the governor, they were connected together, and a 9-inch and finally a 6-inch main completed the distance to Roseville. The gas supplied by the governor was exhausted by the time it had reached the end of the 12-inch main, and so from there on to Roseville we had a poor supply. One of the 12-inch mains we decided to convert to high pressure, and continue through to Roseville. All connections off this original 12-inch main were cut off and transferred to the other 12-inch main. Reynolds governors were placed in pits at intervals along the road; the inlets being connected to the high-pressure main, and the outlets to the low-pressure 12-inch, 9-inch, and 6-inch mains. A connection was made from the 15-inch high-pressure main at Gordon to the converted 12-inch main. The governors were then set so as to give an outlet pressure of 35-10ths; and thus the pressure was equalized over the whole of the area. Another point worth noticing is that, whereas the station-governor supplying Roseville had previously been working at 50-10ths, it was now reduced to 35-10ths, so that the quantity of gas going out of the governor was considerably reduced.

This method was found so satisfactory that we have extended the system until, at the present time, we have something like 160 miles of high-pressure mains, with about 90 district governors working off them. These district governors are capable of sending gas out at any pressure between 10-10ths and 60-10ths; so that with a governor working at 30-10ths there is a considerable margin in the supply to cope with any increase in consumers and extensions before another district governor need be put in, or the high-pressure main further extended. The capacity of this system is apparent, compared with a low-pressure system. In the high-pressure system, the drop may be from the maximum inlet pressure at the boosters to the minimum pressure at the end of the district, which latter we fixed at 8 inches, so that we have at present a permissible drop of 62 inches. Under the low-pressure system, our maximum outlet pressure is fixed at 50-10ths; and to give a reasonable supply to consumers, our minimum pressure should not be less than 20-10ths, so that we only have a permissible drop of 30-10ths.

The flow of gas in a main under low pressure increases as the square root of the pressure; so that to obtain twice the quantity of gas would require four times the pressure, and so on. For high pressures, this is not correct, as the flow is more nearly in direct proportion to the increase in pressure. Hence, we not only have the addition of a much bigger available drop in pressure, but also our delivery increases almost in proportion with the pressure. Take an instance of a 12-inch main 2000 yards long, with an initial pressure of 50-10ths and a final pressure of 20-10ths. This main would deliver 3360 cubic feet per hour. The same quantity of gas could be delivered by a 3-inch main under high pressure with an initial pressure of 70 inches, and a final pressure of 10 inches. This comparison shows that 3-inch and 4-inch mains under high pressure will have a very long life before they become over-taxed. Further, by using high pressure in preference to low pressure, considerably less capital expenditure is required to deliver the same quantity of gas. The only increase in cost is for the boosting; and this is so small that the advantages gained outweigh it. This cost will vary considerably, according to the size of the plant and the quantity of gas sent out every 24 hours. In our own case, the cost is approximately ½d. per 1000 cubic feet. This figure is derived from the total quantity delivered over the twelve months; and it may interest you to know that for the year to June last, the Company sent out 4,481,000,000 cubic feet.

The governors which we use are the Reynolds—an American patent made by the Bryan Donkin Company—which have proved quite satisfactory in use for a period of four years. They are of the leather diaphragm type, and have no mercury, oil, or water seals. They are positive in action; and if properly attended to, give no trouble. It is almost impossible for the governor to fail, and let the high pressure through into the low-pressure mains. We have only had two cases where a governor failed to operate, and in each case the pressure rose to 6 inches, which was by no means the pressure in the high-pressure main. This excess pressure was purely local, and was detected in a very short time, owing to complaints being received of poor supplies; the reason, of course, being that the float in the meter had practically shut the gas off owing to the difference of the water-level. Nearly all these governors are fixed in brick pits in the footpath. Each pit is about 5 feet wide by 6 feet long and 5 ft. 6 in. deep; so that there is plenty of room to get round the governor for cleaning purposes, &c. Wherever possible, the pits are drained. Eight-day "Bristol" recording gauges in water-tight cases are fixed on the inlet and outlet. The cards on these gauges are changed once a week, any irregularity on the records noted, and the governor in question at once examined for any defect. A note is made on the card as to the reason for any variation of pressure, and the card is filed for future reference.

The outlet pressure of the governor does not vary more than 1-10th or so over the 24 hours, except in cases where the station-governor supplying that part of the area is giving out a higher pressure than the local governor is set for. In such a case, the Reynolds governor remains closed until the demand reduces the pressure in the low-pressure mains to the same as the outlet pressure of the Reynolds governor, when the latter opens up and maintains the supply. In most districts these governors remain closed during the greater portion of the 24 hours—only opening in the early morning, mid-day, and evening. By this means, we are able to give an almost constant pressure over the whole of the 24 hours, which is what we are all aiming at, but which, with a low-pressure system of any size, is utterly impossible. This variation in pressure, which cannot be avoided with the generally accepted method of distribution by means of station-governors and comparatively large sized trunk mains, is the cause of the majority of complaints of poor supplies and also of poor gas, as no incandescent burner will stand much variation in pressure without being regulated to suit the alteration. Consequently, as soon as the pressure is reduced at night by reason of the increased consumption, the consumer immediately notices the light going down, with the result that a complaint is received in the morning of a poor supply.

Transmitting Gas to Outlying Holders.

We now come to the transmission of gas to outlying holders, which does not call for any special description, as it has been in use for many years. In this case the main supplying the holder, if large enough, or if the holder itself can be filled during the night, can be used for supplying districts *en route*, by means of governors, as in the previous system. If the main passes any isolated houses, they can be picked up by means of a direct high-pressure supply and a service-governor on the meter, which will reduce the pressure down to the required number of tenths. This method I consider the ideal system of supply; and this brings us to the third system—direct supply of consumers by means of service-governors on the meters.

Service Governors on Meters.

There may be some portion of the area supplied, to which the reinforcement of the low-pressure system cannot be applied; and here is an opportunity for supplying consumers direct from a high-pressure main. We had one instance of this. It was a very scattered area with comparatively few consumers, about 17 per mile, and 8½ miles of 4, 3, and 1½ inch mains supplying these consumers. This net-work of small mains was supplied from an 18-inch low-pressure main, which at that point had a maximum pressure of 35-10ths. I do not like to say what the pressure was at the end of the district. Running parallel with the 18-inch low-pressure main was a 9-inch high-pressure main with a pressure of somewhere about 50 inches at the point where the supply was taken off the 18-inch main to the district in question. To relay the

low-pressure mains with larger ones was out of the question, on account of the cost in relation to the revenue. The same thing applied to laying a high-pressure main to the extremity of the district and reinforcing by means of a Reynolds governor. The solution appeared to be to convert the whole area into a high-pressure system, and supply the consumers through governors fixed at the meters.

The first thing to be done was to fix a service-governor on every meter, and then make a connection from the 9-inch high-pressure main to the 4-inch low-pressure main where it came off the 18-inch main. Two valves were put in, one on the low and one on the high pressure connection; the high-pressure valve being left shut. We were then ready to convert to high pressure as soon as the service-governors were set. On the day fixed for changing over, a number of fitters each provided with a water-gauge started out in the morning to set, approximately, 140 service-governors. They finished at about 1 p.m., and reported all service-governors set to 30-10ths. These service-governors were weighted with the same number of weights as we had found to give 30-10ths outlet pressure when the governors were tested at the works, before being sent out. All that now remained to be done was to change over the connection. A 12-inch water-gauge was fixed on the 4-inch low-pressure main close to the valves, and the valve on the high-pressure connection was gradually opened until the pressure rose to 45-10ths, when the low-pressure valve was closed and the high-pressure valve was opened further, until the gauge showed 6 inches. The fitters were again sent round to all governors, to see if they had taken up the pressure correctly. On the fitters' return, and reporting all governors right, the high-pressure valve was opened up full. A gauge fixed at the extreme end of the district showed over 40 inches; so that we were satisfied that from that date on everyone in the area would have sufficient gas for some time to come.

This system has now been in operation a little over two years; and has been an unqualified success. No single failure of a service-governor has occurred; and the complaints received from consumers are 43 per cent. less than were received from the same number of consumers supplied by low pressure in a similar area. No alterations were made to the mains or services, so that the expense was simply the cost of the governors and fitting, *plus* the cost of the connection to the high-pressure main. The total cost worked out at £288, or a shade over £2 per consumer. All the consumers have an absolutely even pressure of 30-10ths over the whole 24 hours. The pressure in the system varies from 7 inches during the night to a maximum of 50 inches during the hours of maximum consumption. Since converting this district, we have added another 60 consumers, none of whom could have been supplied on the then existing low-pressure system, as the mains could not even supply the consumers already connected. Another area in which about 200 consumers had been applying for gas for the last four years, but which we could not supply under low pressure on account of the expense, has since been laid with high-pressure mains, and consumers are supplied in the same manner as in the previous case. Here, again, complaints are less than with the ordinary low-pressure system.

The governors themselves need very little attention. One fitter examines them every six months, taking about three weeks to go over 200. The leather diaphragms have a life of about two years, but are renewed, if required, at the bi-annual examination. Street-lights in these areas are treated in a similar manner. A half-inch service-governor is fitted just under the lantern, which reduces the pressure to 30-10ths; the burners themselves being adjusted to the required consumption, exactly in the same way as they are when used on the low-pressure system.

Perhaps the most important point in this system of supply is that the consumers have an unvarying pressure, irrespective of the demand; and so we get rid of a number of complaints of poor supply which exist on a low-pressure system, and which are caused by the pressure rising when the station-governors are opened, and then gradually falling to the minimum point during the period of maximum consumption. This drop in pressure, which may be as much as 25-10ths, is what the consumer notices, as no incandescent burner can be adjusted to cope with a drop such as this. The only way to rectify this is to fit some form of low-pressure governor, and set it to within a few tenths of the minimum pressure; and if we are to use governors at all on a consumer's service, then why not supply the consumer direct from a high-pressure main, and give him an absolutely constant and efficient pressure.

Testing High-Pressure Mains.

One point I will put stress on in laying high-pressure mains is that they should be tested to not less than 10 lbs. per square inch, or, preferably, before being used for gas, that they should, after being pumped-up, remain at this pressure without any appreciable loss for 24 hours. The test can be carried out from day to day as the main is being laid, and any leaky joints be immediately discovered and rectified before the ground is filled in. When we started this method of laying mains, we found that nearly every joint leaked; but very soon the men made joints which stood the test required. I even think it well to similarly test low-pressure mains in cases where they are laid dead, as this will preclude any chance of leakage either in the joints or fittings. Money spent on testing while the work is being done is saved in the long run, as it is much more costly to have to open-up and look for leaks at some later period. With gas at 3s. 10d. per 1000 cubic feet, every cubic foot per hour represents a sum of 30s. per annum, which, even in a small distribution system with (say) a leakage of 10 per cent. of the gas made, will amount to a considerable sum per annum.

Nearly all our high-pressure mains are laid with steel pipes in lengths of about 30 feet. This roughly reduced the number of joints per mile to one-third of the number which would be required with cast-iron pipes. This is, in itself, a considerable factor in the reduction of leakage, over and above the fact that cast iron is more or less porous compared with steel. Every high-pressure main should have sufficient valves along the route to control the pressure, if required, in order that any further extensions may be made without difficulty, as no bags or stops can be relied upon to hold against a pressure greater than 10 inches. In cases where the pressure cannot be reduced, resort will have to be made to some form of under-pressure drilling apparatus.

Generally speaking, far too little care is exercised in laying services. Pipes are half screwed home, and then a dab of red lead is given to the remainder of the thread, and the joint screwed up. This will not do for high-pressure work. The joints must be painted inside and out with a mixture of red and white lead (half-and-half) and boiled oil. This mixture does not set hard, and therefore, any movement of the pipes after laying does not break the joints and so cause leakage.

DISTILLATION OF PEAT.

In the "United States Commercial Reports"—No. 272, dated Nov. 19—Mr. C. A. Holder describes a new patented process for the distillation of peat, by which coke, fuel oil, toluol, ammonia, paraffin wax, and acetone are obtained "in sufficient quantities and of such high grade as to prove of great value."

Peat, as taken from the peat beds, the article continues, contains from 80 to 90 per cent. of water, and is of a fibrous cellular structure; so that by hydraulic pressure it is possible to lower the water content only slightly. An important part of the new process is a macerator, that breaks-up the fibrous cellular tissue, and thus allows a more complete separation of the water. After passing through the macerator, the broken peat is compressed into briquettes, which are dried until they contain not more than 25 per cent. of moisture; and they are then fed into a hopper, from which they pass into the retort.

The retort, though very simple, is the basis of the patent. It contains several chambers where different degrees of heat are applied. In the first a temperature of 300° C. (572° Fahr.) is used for driving out the moisture remaining in the peat. In the next chamber the temperature is about 450° C. (842° Fahr.); and here decomposition of the peat takes place. In the last chambers, the temperature runs up to 600° or 800° C. (1112° to 1472° Fahr.), and the oil and water are volatilized. By means of a worm screw, briquetted peat is passed in at one end of the retort, and peat charcoal is discharged continuously at the other end; while from the various chambers the oil, water, ammonia, &c., are drawn off as vapour, and removed from longer contact with the heat.

After leaving the chambers, the vapours pass through a condensing system so arranged that the heavy oil collects at one place, and the water and light oil in the form of vapour, together with some combustible gases, collect in another place. The combustible gases are separated from the water and oil, and are utilized in keeping-up the temperature of the retort, after it has obtained its initial heat from coal; and they are ordinarily sufficient to carry on the subsequent processes without the addition of any further coal.

The coke obtained by the process contains 92 per cent. of carbon, 1 per cent. of moisture, 1·3 per cent. of volatile matter, and 5·7 per cent. of ash It is very hard. It can be left with a larger percentage of moisture; and in this way, since it is softer, it can be used as fuel for domestic purposes. Its chief value, however, is in the manufacture of steel, owing to its wonderful hardness and the high percentage of carbon contained. Various steel makers have certified to its great value for this purpose. From a ton of peat nearly one-third of a ton of coke, valued at $6·08 to $7·30, is obtained.

The oil promises to be particularly useful as a fuel, because of its low sulphur content. An examination of the oil showed it to be a most satisfactory substitute for petroleum. The amount of ammonia obtained per ton of peat is estimated at 20 lbs., with a value of 2 c. or more per pound. Both the oil and the ammonia contain water; but this is readily removed by the application of heat. In addition to these products, about 20 lbs. of paraffin wax, valued at 6 c. to 8 c. per pound, is obtained, and toluol and acetone. The quantity and value of the latter have not yet been ascertained.

With peat costing about $1·95 per ton delivered in the hopper, dry, it is believed that by this process a profit of not less than $3·65 or $4·87 per ton will be obtained; and this does not include any allowance for the toluol and acetone, which may prove to be more valuable than all the other products together.

Peat from different localities gives different results—some peat containing larger amounts of volatile matter than others, and some having a low nitrogen content, while in others it is high. The yield of oil from Yorkshire peat was 26·5 gallons per ton. By varying the conditions of distillation, light or heavy oils may be produced as desired. The yield of oil, gas, and ammonium sulphate can be controlled by regulating the length of time or the degree of heat to which the peat is subjected in the retort.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Increased Toluene Production.

SIR,—Should Mr. Rollason care to read my article again, he will find a paragraph as follows: "The increased quantity of bye-products was negligible; and their value was counteracted by the increased ash and sulphur content of the coke." As "bye-products" referred to a coke-oven plant, and includes crude benzol and tar, it follows that the toluene was not appreciably increased.

I fail to understand how Mr. Rollason arrives at the conclusion that the coal used was high in sulphur, as no figures relating to the sulphur content were given. The temperature of maximum decomposition of limestone is about 812° C.—providing the dissociation pressure is higher than the containing pressure; and if this holds true, limestone can not be used with the "special object" of retarding the evolution of hydrocarbons which come off at an early period of distillation, as it is itself decomposed into CaO and CO_2 at a much lower temperature than 812° C., if under a vacuum, as in a coke-oven.

I note Mr. Rollason says: "Many gas-works are at the present time working to the full capacity of their carbonizing plant." This is quite true; and the fact that many are not, while most gas-works have a "slack" season during the summer months, must not be overlooked.

I cannot dispute Mr. Rollason's figures, which were obtained from experiments conducted at a gas-works; but his toluene yields are extraordinarily high, and give a total of 6 lbs. per ton of coal carbonized on an ash-free basis, against 4·5 lbs. per ton of coal carbonized on an ash-free basis, as quoted on the brochure of the Synthetic Gas Processes Company.

It must not be forgotten that the addition of limestone to coal means an increase in ash content; and this cannot be overlooked by coke-oven people.

Finally, let me quote some figures obtained at the Birmingham experimental plant, using the same quality of coal.

	1.		2.
Percentage of lime	*Nil.*	..	1·91
Charge of coal—cwt.	8·03	..	8·03
Make per ton—cubic feet	11,740	..	11,780
Illuminating power, No. 1 Argand	15·35	..	15·24
B.Th.U.—net	526	..	516
Tar—gallons per ton	13·6	..	13·1

The composition of the gas varied very slightly, with less sulphur from the limed charge. The ash in the coke increased by 4·3 per cent., and the sulphur by 0·17 per cent.

B. DUNGLINSON.

Jan. 6, 1916.

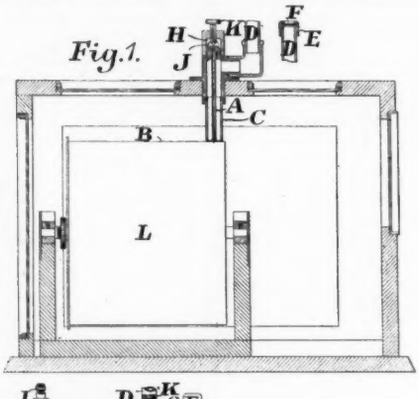
REGISTER OF PATENTS.

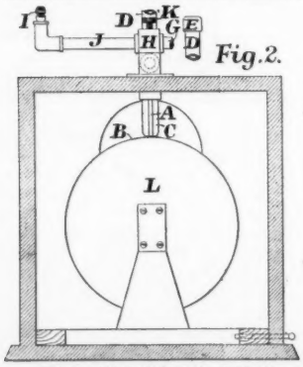
Sulphuretted Hydrogen Recorder.

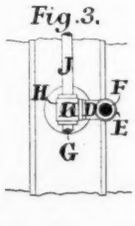
EDWARDS, A., of Leeds.

No. 379; Jan. 9, 1915.

The gas to be tested is brought into contact with lead paper prepared in the usual way, and used either wet or dry; and the invention is characterized by "the intimate application of an adjustable jet of gas to a prepared moving surface without introducing friction or mechanically fouling the prepared surface, and without the use of liquid seals or sealed chambers, in such a manner that the action of the sulphuretted hydrogen impurity is localized, and that the gas used is automatically collected and disposed of by combustion without nuisance." To effect this end, "advantage is taken of the lesser specific gravity of gas and air mixtures as compared with that of air alone."







Edwards' Sulphuretted Hydrogen Recorder.

Fig. 1 is a sectional side elevation of the apparatus; fig. 2 a front elevation (partly in section); and fig. 3, a plan of part of fig. 1.

The jet of gas issuing from the lower end of an upright small-bore jet pipe A impinges directly and intimately upon the paper B (carried by a revolving drum), slightly below the jet orifice but not in actual contact with it. It ascends an outer glass tube C surrounding the lower portion of the jet pipe; and then passes automatically into an upright suction tube D, which is surmounted by a cap E carrying wire gauze F where the gas is burnt with a non-luminous flame. The length of the tube D is so adjusted that the ascending column of gas draws air through the space between the paper and the tube C, and so prevents any escape of gas at this point; while the end of the tube C is so shaped that the action of the gas is localized upon the paper.

A constant flow of the gas to be tested is maintained through the inlet pipe G; then through a jet pipe inlet chamber H; and the gas is finally led away to a pilot light I by way of an outlet pipe J. The volume of the gas impinging upon the paper is regulated by a needle screw adjuster K fitted in the chamber H to give the desired sensitiveness—say, 0·3 cubic foot per hour.

The prepared paper, bearing printed hour lines, can be applied in strip form and led past the jet pipe orifice, or it may be in disc form supported about a vertical revolving shaft, or (as illustrated) in ordinary sheet form disposed about the circumference of a revolving cylindrical drum L, arranged to take seven daily records by successive lateral displacements of the drum or drum support.

Five jets may, the patentee points out, be disposed side by side above a single cylindrical drum, and coupled to the main inlet and the four outlets of a set of four purifying boxes—"the records serving as a check upon the working, particularly where the backward rotation system is in use."

Instrument for Measuring Radiant Energy.

RICHMOND GAS STOVE AND METER COMPANY, LIMITED, and HARTLEY, H., of Warrington.

No. 1733; Feb. 3, 1915.

This invention has reference to "apparatus for measuring or ascertaining radiant energy, and more particularly heat energy; and it has for its object to provide an accurate, simple, and easily-used apparatus or instrument for this purpose."

Any details of construction of the radiometer referred to are not needful in this connection, as full particulars regarding it were published in an article that appeared in the "JOURNAL" for March 30 last year, when an illustration was given [fig. 3, p. 794] similar to that which accompanies the present patent specification. It may, however, be interesting to state the claims made by the inventors. They are as follows:

1.—An apparatus for measuring or ascertaining radiant enegy, comprising a casing or container, a metallic heat absorbing body within it, and a separate means for indicating or determining temperature changes in the body.

2.—An apparatus for measuring or ascertaining radiant energy, a casing or container adapted to be maintained at a constant temperature, a metallic heat absorbing body within it having connected with it a thermometer, an opening in one side of the casing or container through which the radiant heat strikes the body, and a screen adapted to be moved in front of, and from in front of, the said opening.

3.—An apparatus for measuring or ascertaining radiant energy comprising a container or casing, and a heat-absorbing body within it, and adapted to be held in place in it by clamping means.

4.—Apparatus for measuring or ascertaining radiant energy, constructed and adapted to be used substantially as set forth and shown.

Igniting Apparatus for Gas-Burners.

SOUTH METROPOLITAN GAS COMPANY and BUCKETT, W. J.

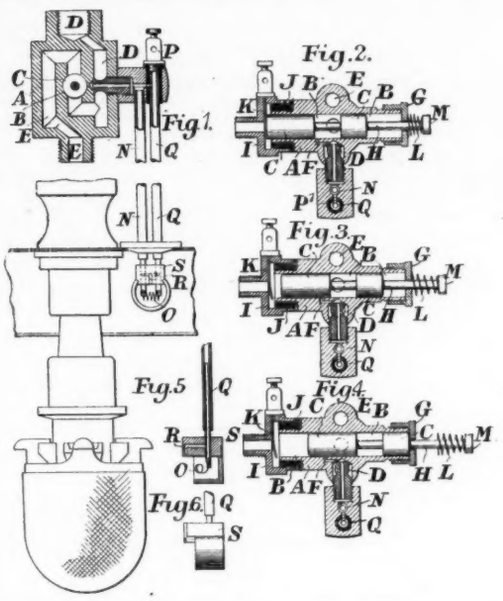
No. 3690; March 8, 1915.

This invention refers to electrically ignited gas-burners in which a bye-pass jet is first ignited by a filament brought to incandescence by an electric current; the burner proper being lighted from the bye-pass in the ordinary way.

Fig. 1 (p. 95) is an elevation of a gas-burner, partly in section, with the invention applied to it. Figs. 2, 3, and 4 show in horizontal sectional plan the valve for the supply of gas to the burner and to the bye-pass in three positions—viz., burner and bye-pass supplies both open; burner supply open, and bye-pass closed; burner and bye-pass supplies both closed. Figs. 5 and 6 are sectional and outside views of the bye-pass ignition device detached.

The pneumatically operated valve employed is of the horizontal piston type, and arranged to work differently from any previously used of this character, so as to supply both the burner and the bye-pass, to cut off the latter without cutting off the former, and to make and break the electric circuit as and when required. The valve comprises a metal casing A in which is a horizontal cylindrical chamber B for the piston C. The chamber has, however, besides the gas inlet D and the outlet E to the burner, an additional outlet F, which leads to the bye-pass; and the piston C is so formed that it is capable of covering both the main gas-passage and the outlet F simultaneously (as in fig. 4), uncovering both passages simultaneously (as in fig. 2), or covering the outlet while the main gas-passage remains open (as in fig. 3). The chamber B has at one end a cap G with a central hole, in which the rod H of the piston works; and at the opposite end there is the union

I, to which is connected the pipe of a pneumatic switch [not shown]. The union is insulated from the casing by the insulating bush J, but has a terminal for connecting to one lead of the battery. Inside the union is a contact-blade K adapted to meet the piston when it is moved to that end of the chamber B. On the rod of the piston is a spring L arranged between the cap G and the head M.



Buckett's (South Metropolitan Gas Company) Gas-Burner Igniter.

The valve shown is arranged to act by suction; and when suction is applied by the pneumatic switch, the piston is drawn into the position shown in fig. 2 and the spring L is compressed. In this position, as stated, the gas-passages to the burner and to the bye-pass are both open, and the electric circuit is complete through the blade K, the piston, the casing, the metal pipe N, the filament O, the metal pipe Q, and the terminal P, which is connected to the battery. The gas for the bye-pass flows by both pipes N and Q to passages R in the fire-clay block S, whence issues an igniting jet. The opposite ends of the filament are held in the ends of the pipes N Q, which are made telescopic so as to be detachable and adjustable longitudinally. The fire-clay block, the ends of the pipes N Q, and the filament O form together an igniting head, which is movable with regard to the burner without disturbing the distance between the gas outlet and the filament as previously set or adjusted.

When the piston is in the position of fig. 2 the ignition takes place; but as it is undesirable to maintain the filament in a state of incandescence and keep the bye-pass open after the ignition has taken place, the strength of the spring L is so adjusted that, as soon as the suction weakens (which will be the case in a short time owing to the fact that the joints are not absolutely air tight), the spring will move the piston so as to clear the contact-blade K and cover the outlet F which leads to the bye-pass, thereby cutting off the electric current and the igniting gas-flame. The spring pressure is not sufficient to do more than this, and therefore the burner remains alight until the pneumatic switch is operated in the opposite direction to move the piston C to the position shown in fig. 4.

Charging Gas-Retorts, and Withdrawing Coke therefrom.

BANCROFT, F. J., and HANSFORD, J. B., of Barnet.

No. 4602; March 24, 1915.

This invention relates to apparatus whereby stop-end retorts can be charged substantially in one, two, or more operations, in a manner similar to that described in patent No. 13 218, of 1914; while the coke can be withdrawn through the charging door after distillation. For the latter purpose a withdrawal or drag device, longitudinally movable within the retort, is, according to the present invention, operatively associated with the charging apparatus indicated.

The charging portion of the apparatus (except for some modifications) is similar to that described in the earlier patent. The central portion of the charging bed, however, according to the present invention, has to be curved or arched to enable it to ride over the drag bar or bars.

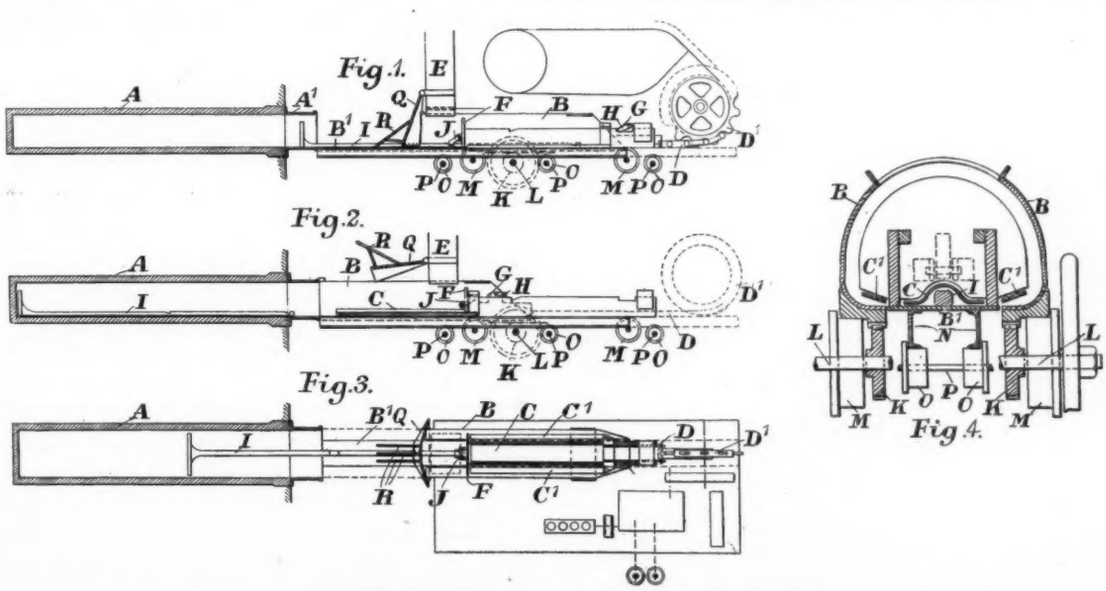
Fig. 1 is a part longitudinal section and elevation of the charging and discharging apparatus; the bottom of the charging trough being in the charging position in front of a retort with the discharging drag bar withdrawn. Fig. 2 is a similar view, showing the positions the parts assume during the charging of the trough with coal. Fig. 3 is a sectional plan; the drag bar being only partly withdrawn from within the retort. Fig. 4 is a cross section (to enlarged scale) showing the charging bed or tray, the trough, and the means for shifting the sides of the latter. The apparatus shown is designed to be mounted on a trolley or carriage in which it is adjustable, both vertically and horizontally, to enable it to be brought opposite the mouth of any retort to be operated on.

A is a retort, B and B^1 are the sides and bottom of the charging trough over which the charging bed or tray, consisting of plates C C^1, is adapted to travel forwards and backwards when pushed or drawn in customary manner by the chain D driven by the sprocket wheel D^1. E is a shoot by which coal is fed on to the tray—being connected with a hopper carried by the trolly. The charging-head F has rearwardly extending rails of comparatively heavy section and connected together by a bridge plate. The central plate of the charging bed is arched to allow of it riding over the drag-bar I. The central and side plates C C^1 are connected at their rear ends by a double bridge arrangement as described in the 1914 patent. To the bridge are attached side plates carrying brackets G, with pivoted catches or dogs H that can be turned into positions in which they engage with notches on a rail F when the charging head is to be moved simultaneously with the charging bed.

The drag-bar I has a turned-up head, and is provided with notches at suitable distances apart along its length. It can be pushed forward along the retort by hand, or by the charging apparatus, into the position shown in fig. 2, and be withdrawn through the charging door of the retort by engaging a claw clutch or equivalent member J, pivotally mounted on the charging head F, with one or other of the notches on the drag-bar, and then retracting the head, and with it the drag-bar. By means of the series of notches the drag-bar can be withdrawn by stages; and as it is withdrawn it slides along the bottom of the charging trough—being provided with an aperture for the passage of the bar.

Besides the notches formed at the rear ends of the rails of the charging head and employed in co-operation with the pivoted catches or dogs H for reciprocating the charging head simultaneously with the charging tray, as described in 1914 specification, additional or auxiliary notches are provided along the length of the rails; so that if the charging tray be pushed into the retort and subsequently withdrawn to a small extent, then, by engaging the pivoted dogs H with a pair of the auxiliary notches, the charging head can be advanced within the retort to a further extent than before. Thus any cavity existing in the charge deposited in the retort will be obliterated by reason of the additional push imparted by the head to the deposited charge. This "push-up" shot may be repeated as often as necessary.

The charging trough, according to this invention, is formed with its bottom plate or portion B^1 separate from the sides B. The bottom



Bancroft and Hansford's Retort Charging-Discharging Machine.

plate, owing to the pressure of the movable parts of the charging structure upon it, is moved together with them, when the apparatus is to be adjusted so as to register with the retort mouthpiece. The sides B of the trough are adapted to be moved independently of the bottom plate in longitudinal directions relatively to the plate by means of suitble mechanism. In the drawing, the sides of the trough are fitted with sets of dependent parts having rack teeth adapted to mesh with toothed pinions K keyed to rotatable shafts L, on which are also loosely-mounted flanged rollers M, on which the dependent parts are arranged to bear. By turning one or other of the shafts L the sides B will be racked or traversed along; being guided by rollers M.

The bottom plate of the trough may be arranged to rest on longitudinal girders N that bear on flanged rollers O loosely mounted on spindles P.

When coke is to be withdrawn from a retort, the bottom plate of the charging trough is advanced to the retort mouth and locked in position —the sides of the trough remaining in the retracted position, as shown in fig. 3. The drag-bar I, with the turned-up head, is then drawn out through the charging door by hooking the claw clutch J into a notch of the bar and retracting the charging head. As the bar is retracted it slides on to, and along, the bottom plate B^1 of the trough; but its withdrawal can be effected in one or more stages as explained, by making use of the series of notches.

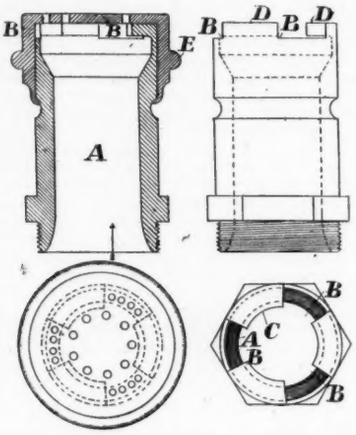
With a view to clearing the bottom plate of the trough of the coke as it is withdrawn and causing it to fall in a desired direction, guide-plates or distributors are provided. These consist of plates Q suitably shaped and pivotally supported from the sides of the charging shoot E leading from a storage hopper arranged above the trough; and they can be turned into, and out of, the operative position as desired. The guide-plates may be fitted with one or more forwardly projecting bars R for the purpose of breaking up the withdrawn coke or residues before reaching the guide-plates.

Regulating the Gas Supply to Atmospheric Burners.

YATES, H. JAMES, of Essex Works, Aston, ROSE, A., and BELLAMY, W., of Hockley Hill, and DOLPHIN, J., of Harborne, Birmingham.

No. 3868; March 11, 1915.

This invention has reference to that type of regulating means in which a perforated cap is adapted to rotate upon the top of a nipple in which holes are so arranged that, by rotating the cap so as to increase or decrease the number of perforations in the cap registering with the perforations in the nipple, the supply of gas can be increased or diminished. The opening in the top of the nipple is so arranged that the gas constantly passes through the perforations in the central area of the cap which are not affected by the turning of the cap.



Yates, Rose, Bellamy, and Dolphin's Atmospheric Gas-Burner.

A sectional elevation is given of a gas supply nipple and cap in accordance with the invention; also a plan of same, a side elevation of the nipple separately, and a plan of the top of the nipple with the cap removed.

The internal diameter of the top of the nipple is preferably made larger than the internal diameter of the base or main portion of the nipple at A; and this top part is made with a partial internal flange divided into (preferably) three equal parts by substantially radial slots B, which extend from the central opening C of the flange to the periphery and are cut through the flange into the enlarged top portion of the nipple. Fitting on the flat top D of the nipple is a perforated cap the central area of which, corresponding with the central aperture in the flange of the nipple, is perforated with holes for the constant passage of the gas through the cap, and outside this area the cap has (say) three groups of perforations; preferably arranged in one and the same circle concentric with the cap—the groups of holes corresponding in number with the alternate gaps B and solid portions of the flange on the top of the nipple. The cap fits closely against the uncut away portions of the flange by the rim of it being closed into an annular groove so arranged as to permit of the cap being turned when its milled edge E is gripped.

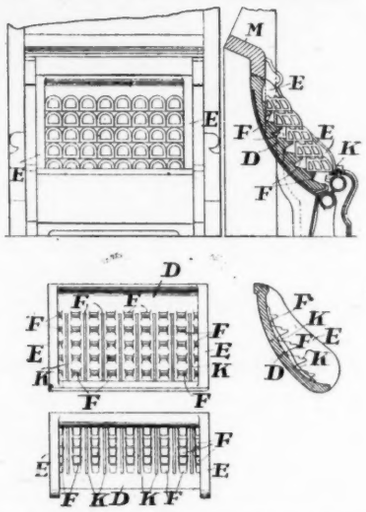
The gas, rising through the body of the nipple, expands as it passes into the upper part of larger diameter, and a portion of the expanded gas passes through the constantly open holes in the central area of the cap; and when the cap is turned to such a position that the three groups of perforations in the outer ring coincide with the three gaps B in the top of the nipple, the gas passes through all the perforations. But by turning the cap through a small angle, one, two, or more of the perforations in each group in the outer ring of perforations will be closed by riding over the solid portions of the end of the nipple, until, when the cap is turned through a sufficient angle, all the outer perforations will be closed. Owing to the fact that the gas, after passing through A, has expanded in the enlarged upper part of the nipple before passing through the perforations, "the roaring or hissing noise of the burner is prevented or minimized."

Gas-Fires.

FLETCHER, RUSSELL, AND CO., LIMITED, and BANKS, W., of Warrington.

No. 12,068; Aug. 21, 1915.

In a gas-fire according to this invention, the front of the fire-brick or backing is dished or concaved between the sides, so that it curves upwardly and rearwardly from about the horizontal to about the vertical, and is provided with projections for supporting the radiants, which are arranged in rows disposed one above the other.



Banks' (Fletcher, Russell, and Co.) Gas-Fire.

A front elevation and a transverse section of one form of the fire (fitted in an ordinary coal fireplace) are given; also a front elevation, transverse section, and plan of the fire-brick or backing.

The front surface D of the fire-brick is dished or concaved between the sides E so that it curves upwardly and rearwards from about the horizontal to the vertical. The front surface has formed on it rows of projections F for supporting the rear ends of the radiants, the front ends of the first row of which rest on a lip H, and each of the other rows on the row immediately below it. The radiants thus also curve or slope upwardly and rearwardly, similar to the front of the fire-brick.

The nozzles of the burners are inclined so that they direct the gas-flames between the columns of projections more or less in the direction of the initial part of the curve of the front of the fire-brick. Ribs K are provided on the curved surface of the fire-brick between the projections, and the space between the top of the fire and the back of the fireplace is closed by a tile M of refractory material.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

London Street-Lamps.

Mr. GEORGE TERRELL asked the President of the Local Government Board whether his attention had been called to the waste of electric energy which was taking place in the London district by the blacking over of the powerful street-lamps as a protection against hostile aircraft raids; and whether he would take steps, in the interest of public economy, to require that, instead of blacking powerful lamps, these lamps should be replaced by lamps of lower candle power?

Mr. HAYES FISHER, in reply, said that the President of the Local Government Board was strongly in favour of any economy that could be effected in this direction. He understood that in a very large proportion of the public lamps the candle power had already been reduced, but that in some cases the type of lamp employed was such that to reduce the candle power would involve a considerable amount of initial expenditure which would be thrown away in so far as it was not recouped by savings before the end of the war. He was informed that untreated lamps even of low candle power would not fulfil the main object of the regulations.

Artificial Manures.

Sir J. D. REES asked the Parliamentary Secretary to the Board of Agriculture whether His Majesty's Government was considering the propriety of stopping the export of all artificial manures from this country, and of reducing the price at which sulphate of ammonia was supplied to farmers from £14 10s. per ton to some figure nearer the normal price of £10 10s.?

Mr. ACLAND stated that the export of all artificial manures was pro-

hibited, and at the present time no licences were being issued except for certain quantities of sulphate of ammonia in excess of calculated home requirements. The matter of further restriction was under consideration.

Replying to further questions, Mr. ACLAND said it was not an easy thing to fix prices. The figure now quoted was £16 15s. per ton.

British Gas Undertakings in Germany.

In the "JOURNAL" for Dec. 28 (p. 711) two questions were published, of which notice had been given by Mr. King. Regarding the first, Mr. PRETYMAN said he understood that the arrangements for the transfer of the Frankfort-on-Main gas undertaking were submitted to Parliamentary Counsel and received his approval. Replying to the second question, Mr. RUNCIMAN said that he was aware that large amounts of British capital were employed in the manner stated. Arrangements were made last June for the registration with the Public Trustee of particulars of British property in enemy countries and in territory in enemy occupation. Due consideration would be given to all the circumstances in any steps which may be taken with regard to enemy property in this country.

Standing Order Stage of Private Bills.

For the first time in living memory all the Private Bills to be considered by Parliament in the ensuing session are to be unopposed at the first, or Standing Orders, stage. There are only 28 Bills in all.

LEGAL INTELLIGENCE.

ASSESSMENTS AND INCOME-TAX.

An Edinburgh Appeal.

In the Lands Valuation Appeal Court of Scotland, last week (before Lords Salvesen, Mackenzie, and Cullen), there was heard an appeal by the Edinburgh and Leith Gas Commissioners against a decision of the Valuation Committee of the City of Edinburgh in fixing the yearly value of their undertaking at £76,932. The Commissioners claimed that it should be reduced to £72,190. The difference of £4000 odd was the amount of income-tax payable by the Commissioners upon the profits of the undertaking. The Commissioners contended that they were entitled to a deduction of income-tax as expenditure incurred by them in carrying on the undertaking; and that the true valuation of the concern for assessment purposes could only be ascertained after the income-tax had been deducted from the revenue of the undertaking. The valuation of the undertaking is made up on the revenue principle; and until the present year the Assessor had allowed the amount of income-tax paid by the appellants as a deduction in arriving at the valuation of the undertaking. The Assessor maintained that the income-tax was purely personal, and could not enter as an element into the valuation of heritable subjects. The Valuation Committee sustained the Assessor's valuation; and the Gas Commissioners appealed. The Court, without calling on Counsel for the Assessor, affirmed the decision of the Valuation Committee.

Lord SALVESEN said the question was whether in valuing the gas undertaking the Gas Commissioners were entitled for the purpose of ascertaining the annual revenue to deduct from their net profits the amount of the income-tax levied under Schedule D. The only really strong argument presented was that there had been a consistent practice in the past on the part of Assessors to concede this deduction. From one point of view, this was a very strong argument, because Assessors applied their minds to these questions with a great deal of knowledge and considerable experience; and one would presume that a rule which had been established by practice would have a basis in law. But it happened from time to time, as the law in the matter of valuation developed, that they found a practice which had been consistently adhered to had nevertheless been decided by the highest tribunal to be wrong. No better instance of this was to be found than the case of the assessment of public sewers, which was established by the House of Lords, after something like fifty years of contrary practice, in which all the Assessors throughout the country had concurred. Practice did not go a very long way when the point had not been raised in Court. Now that this point was raised, it seemed to him very clear that they could not, in fixing the revenue of an undertaking for the purpose of settling the annual value of the subjects, deduct from the revenue a tax which was assessed upon the revenue. The undertaking had to be assessed upon the revenue principle. The Court had to ascertain what the revenue would be; and in ascertaining what the revenue would be, it seemed to be a contradiction in terms to say that the revenue should suffer the deduction of the amount of income-tax which the Government levied, and which might vary from year to year according to the requirements of the Government.

The other Judges concurred.

Fraud on the Derby Gas Company.

Godfrey Jenkinson, who had been discharged from the employ of the Derby Gas Company as a motor lorry driver, was sentenced by the Borough Magistrates on Monday of last week to three months' imprisonment, for defrauding the Company, by calling at houses, representing that he had been authorized to collect the "gas money." The amounts involved were relatively small; but the impudence of the prisoner, against whom there was a previous conviction for larceny, consisted of his making use of keys which he had procured from the Company's storeroom before leaving their service. In two cases, his attempts had been frustrated by the circumstance that the keys would not fit. Prisoner, who pleaded guilty, suggested that he was under the influence of drink when committing the offences.

Messrs. James Miller, Son, and Co., of West Nile Street, Glasgow, announce that they have terminated their agreement with the Berlin Aniline Company, Limited, whose sole representatives for Scotland they have been for almost forty years.

MISCELLANEOUS NEWS.

POSITION OF THE WIGAN GAS UNDERTAKING.

Sir Corbet Woodall's Report.

Gas matters occupied a considerable share of attention at the last monthly meeting of the Wigan County Borough Council; reference being made to the report of Sir Corbet Woodall, who had been called in to advise the Gas Committee as to the position of the undertaking.

Mr. FARR, in proposing the adoption of the minutes of the Gas Committee, called attention to the report of Sir Corbet Woodall, who, he said, had visited the works. The report contained many valuable suggestions, and it showed that the undertaking had come through the examination very well indeed. Though the plant was perhaps antiquated, it had been well cared for, the best had been got out of it, and the amount of gas obtained per ton of coal carbonized compared very favourably with more up-to-date plants. The report confirmed very largely the one prepared by their own Engineer (Mr. F. Betley), and completely endorsed the need for mechanical stokers, as suggested by the previous ex-Chairman. Other suggestions were made which, if carried out in full, would require an expenditure of between £20,000 and £30,000. The Committee decided that such an expenditure was hopeless at the present time, and had resolved to do that which would give most benefit to the undertaking without incurring any very great expense. They had come to the conclusion that nothing would help more than increasing the pressure over the whole system. By doing this, they would have a better supply, especially in the out-districts, and they would make better friends of their customers; while it would lead to a largely increased output of gas. The Committee would have to be prepared for a greater percentage of leakage, which was a very important thing in a town like Wigan, though looked at as a whole the increased pressure would be advantageous to the consumers. It was suggested that the 16 and 18 inch mains should be replaced by 24 and 30 inch ones; and a booster plant with fan to force the gas into the holders would give increased pressure on the larger volume passing through the mains. They would require a new condenser; and they were also advised to complete the second unit of the carburetted water-gas plant. Another thing suggested was the overhauling of the retort-house, the installation of mechanical stokers and conveyors, the improvement of the sulphate plant, and many other improvements which at present were not practicable. They had a small reserve fund; but on going into the financial position of the undertaking, he was shocked to find that machinery which had been down 39 years was not yet paid for. There were still instalments to the sinking fund owing. He did not know who had control of the gas-works 39 years ago; but having got borrowing powers extending over 60 years, no doubt they thought they were being smart in tying a millstone about the neck of posterity. "We have the misfortune to be the posterity," he observed. The Committee were therefore faced with the question of superseded capital. Now capital to replace the old plant would amount to about £600; and if they were going to pay this out of the reserve, what was going to happen when they tackled the retort-house—which they hoped to do in a few years' time? They would have thousands of pounds of superseded capital to meet. They wanted to conserve their reserve fund as far as possible, and wondered whether the Local Government Board would sanction a loan with which to meet the expenditure, for (say) the short term of fifteen years, or allow them to go ahead with the work and, after the war, treat the matter as if the work had not been done. Several other towns similarly situated had been successful in getting informal sanction to do immediately pressing work, and for the matter to be considered after the war. When Sir Corbet Woodall's suggestions were carried out, they hoped to have a bright future, with a larger body of satisfied customers, and a greater output of the commodity the works were called upon to supply.

Mr. M'CURDY, in seconding the motion, said the report not only gave them a right lead with regard to the financial policy to be pursued, but pointed to them how to attain a high standard of efficiency. The report suggested the necessity of new retort benches, mechanical stoking plant, governors and booster fan, the completion of the carburetted water-gas plant, a new set of condensers, the replacement of the exhausters by others of larger type, reconstruction of the sulphate of ammonia plant, and concentration of, and the installation of, new, boilers. The expenditure requisite was entirely out of the question in these days of rigid economy; but Sir Corbet Woodall emphasized very strongly the point about increased pressure. Were this matter proceeded with at once, it would remove a serious cause of complaint. This, together with the completion of the carburetted water-gas plant, new condensers, and mains, would complete the work possible just at present. The final portion in Sir Corbet Woodall's report was most valuable. In September last, when discussing the raising of the price of gas, he mentioned the huge sum which had been paid out of unearned profits for the relief of the rates, and he urged that the high price of gas was caused by the strain on the plant at the gas-works having been too great. He was glad his remarks had been amply vindicated by the report, which stated: "The fairly considerable works now calling for execution should have been dealt with in detail in past years. The amount spent annually upon upkeep of works, plant, &c., has not been sufficient; and consequently you have now to bear a burden, part of which should have been already carried. It is not for me in this report to discuss principles which should determine the distribution of profits made by your gas undertaking. One thing is, however, clear, and should be faced by the Corporation—namely, that no balance to the credit of a revenue account can be called, and dealt with as, profit so long as the condition of the plant is below a proper standard of efficiency. Within the past ten years £100,000 has been allocated from gas revenue to purposes in which the gas consumers, as such, have no special interest. This is in addition to the ordinary municipal rates. The policy so indicated should be discontinued until the property is brought to a satisfactory standard of efficiency—a suitable method being probably the creation

of a suspense account, to be liquidated over a number of years." It was no use indulging in any recriminations over the past. What had been done or what should have been done would have no influence on things as they now were. But they ought to turn to a new page in the history of the undertaking. The Council as at present constituted would not allow them to go back to the policy of their predecessors. He felt that it would not be many years before they were able to bring the plant to such a high state of efficiency as would make it one of the most successful business departments of the Corporation.

The minutes were adopted; and it was decided to apply to the Local Government Board for sanction to borrow £5505 to carry on the work immediately decided upon.

GAS MATTERS AT STOCKPORT.

Various topics relating to gas manufacture and distribution were touched upon at the monthly meeting of the Stockport Town Council last Wednesday.

Mr. FERNS asked the Chairman of the Gas Committee (Mr. J. Winter, J.P.) to make a statement with regard to the number of recent complaints as to the quality of the gas. The "fault," he believed, arose from the inability (through the war) of the Gas Department to get the material they wanted to give the proper quality or quantity. He thought it would be an advantage if consumers knew the difficulties the Gas Committee had to contend with. They were doing their best, and under the special circumstances the public should be asked to put up with things.

Mr. STOCKTON said, from a business firm's point of view, he hoped the illuminating power of the gas would not be further reduced.

The MAYOR (Mr. T. W. Potts, J.P.) asked whether the gas supplied for cookers was affected. Complaints had been made at his residence that sufficient heat could not be obtained from the cookers.

Mr. WINTER said it must be admitted that for the last few weeks the gas had not been as good as it ought to be. This was accounted for by the fact that some had escaped into the holders without going through the purifiers. The Gas Engineer (Mr. Meunier) was at present endeavouring to remedy the fault; but in order to bring about a satisfactory result, the works would have to close-down for 16 to 24 hours. At a time like the present, it was impossible to do this. He asked the Council and the consumers generally to "bear with the gas" until, in a week or two, a remedy could be brought about. With regard to the lack of pressure, this was due to the fact that, owing to the decline of labour, they were compelled to conserve as much gas in the holders as possible. During the present short days, there was a great demand for gas; and they could not allow it to go out as freely as they would like to, because they were already hard-pressed to cope with requirements.

The Gas Engineer having reported at the last meeting of the Gas Committee upon the difficulties he was experiencing with regard to the cartage of coke, stated that he proposed to get the local bye-laws waived in order to allow one carter to take charge of two horses and carts. The Council confirmed the minutes of the previous meeting of the Committee, at which the Engineer also reported that, on account of the scarcity of labour, he had been using more oil. Coal deliveries were reported to be "very bad, except in the case of two contractors."

MANCHESTER GAS-METER TESTING DEPARTMENT.

Report of the Justices Committee for 1915.

At the Annual Meeting of the Justices of the Peace for the City of Manchester, on Friday last—the Lord Mayor (Alderman Copeland) presiding—Colonel H. T. Crook, D.L., M.Inst.C.E., submitted the annual report of the Justices Committee on the Gas-Meter Testing Department, London Road, Manchester.

After stating that the Inspector (Mr. S. Dyson) and employees of the department had continued to carry out their duties in a satisfactory manner, the Committee say: "A few years ago the Manchester Corporation Gas Committee decided to have all meters re-tested which had been in use for a period of ten years. About 70 per cent. of the meters which were submitted for re-examination were rejected for various causes, but chiefly owing to incorrect registration or from their having ceased to register, which was the case with a considerable number. Recently the Gas Committee decided to have the meters re-tested which had been in use seven years or upwards. Since this was decided upon, 1612 meters have been re-tested; and 568 only were found to be correct, which clearly proves that it is essential that there should be an examination of all meters which have been in use even for a shorter period than seven years. This has been the contention of the Committee for many years. One of the meters re-tested was a five-light wet meter which had been examined and sealed as being correct at the Committee's station nineteen years ago—that is, six years before the index-test was instituted. Upon applying the tests required by Statute, it was found to be registering 2 per cent. fast, and the index proved to be registering a further 40 per cent. fast. In October, the Chairman and Deputy-Chairman of the Birmingham Justices' Gas-Meter Testing Committee visited the station for the purpose of making inquiries regarding the methods adopted in Manchester for testing gas-meters; and they were much impressed with the thorough and complete arrangements for carrying out this work."

Increased Wages at Keighley.—In connection with a recommendation of the Gas Committee that the wages of gas-works employees should be increased, Alderman Smith informed the Keighley Town Council that the question had been gone into with the men and a representative of the Union; and the increase had been accepted verbally by the Union. The concessions would mean between £900 and £1000 per annum. A portion of the new carbonizing plant was now in operation; and it was proposed to increase the public lighting at once, by putting into use 850 lamps, instead of 217 as at present.

DIFFICULTIES AT PERTH.

Breakdowns in the Gas-Works Plant.

Since the advent of 1916, the officials at the Perth Gas-Works have, as is reported in the "Scotch Notes," experienced considerable difficulty with the plant at the works; and the subject has received the close attention of the Gas Committee. Last week matters reached an acute stage, when the plant broke down in several places, and the output of gas was found inadequate to meet the consumption. On Friday evening, a special meeting of the Gas Committee was held to discuss the situation. Ex-Bailie Wright, the Convener, presided, and the proceedings lasted for three hours. It was intimated that Mr. Duncan, the works foreman, had tendered his resignation. The Engineer and Manager (Mr. David Vass), who had been asked to furnish a report on the causes which had led up to the hitch, submitted his statement; and he was instructed to take steps to secure a new foreman. A Special Committee were appointed to co-operate with him in the close supervision of the works.

Mr. Vass's report upon the matter(which is dated Jan. 4) was in the following terms:

I regret that the opinion formed as to my ability to keep up the full pressure of gas has not been realized, in consequence of several unexpected accidents which have happened in close succession to each other. In my earlier report, I stated that, owing to the failure of our coal bucket elevator, we were entirely depending upon the hydraulic hoist, and that this was being taxed to its utmost. At 2 o'clock on the morning of Dec. 24, the hoist failed to work; and I turned out, along with the foreman, and renewed the valve-gear, and started it. But the foreman was called out a short time after, owing to it having failed again; the failure this time being due to a stoppage in the water-supply pipe of the hydraulic ram. We managed to get it clear; but the resulting delay caused a stoppage of the coal supply for working the stoking machines; and hand-charging was partly resorted to. We expected to make up for the loss of the stock of gas caused by this stoppage at the end of the week; but on the night shift of Sunday, Dec. 26, the combined stoking machine developed two electrical faults, and we could not get full work from it. The machine was partly wrought till daylight, when we procured the assistance of an electrician, and it was found there was a burn-out in the armature of the pusher motor of the combined machine. The armature was taken out and replaced by a spare one which we had in stock, and the machine was started after four hours' delay. The fault on the coal-charging motor could not be located, and was not discovered until two days later. During the time of replacing the armature, we began work with our spare pusher and hand charging; but the spare pusher also failed us, on account of a cast-iron bracket giving way. The retorts were consequently left uncharged during the replacing of the armature, as it was impossible even to draw by hand the charges that were in.

At 4 a.m. on the following morning we were again called out, owing to the combined machine having been seriously damaged by the machineman having started to travel along the retort-house with the ram partly extended. We were unable to work the machine, and consequently were unable to recharge the retorts until the damaged ram had been removed. The removal and replacement of the ram took in all four hours; and owing to the early hour of the breakdown there were no men available for working hand-charging, and retorts were left idle for the space of two hours at the withdrawal, and two hours later at the replacing of the ram. Hand-charging was carried on as far as possible. We were then reduced to the barest possible reserved stock, and might have carried through without serious reduction of pressure but for the accident to the hydraulic pumping engine. At 4 p.m. on the afternoon of Sunday, the engine broke down; and an examination showed two damaged cotter-pins. One of these was renewed and the engine again tried; but as it still failed to act, we secured the services of engineers in the town, and found a serious fracture of the barrel. It was not until 6 p.m. on Monday evening that the damaged part was repaired and the engine restarted. During the interval—*i.e.*, from 4 p.m. on Sunday till 6 p.m. on Monday (26 hours in all)—hand-charging was carried on continuously with all the men available; but the results produced by hand-charging were only about 50 per cent. of that obtained from machine work, with the result that at dusk on Monday we had only a very small stock of gas in the holders. The pressure was reduced as far as possible, but at 8 o'clock the holders were entirely empty.

The change-over from heavy machine charges to hand charges gave considerable trouble from the ascension-pipe getting stopped owing to the intense heat; and since resuming work with the machines, we have had considerable difficulty in clearing these pipes in order to get the full supply from the retorts. We have put on all the available men; and in the afternoon of yesterday we received assistance from the Surveyor's Department with a view to overtaking the work. There is only one mechanic in the works whose duty it is to give daily supervision to all the running machines; but this man has been off duty for the past fortnight through an attack of influenza. My foreman, Mr. Duncan, was off duty through illness for ten days during the time when we had our former difficulty with the failure of heating of the oven; and after each of the accidents recently he was laid aside for a shorter or longer period before we had fully got out of difficulty. He was on duty from 6 a.m. to 5 p.m. on the day following the visit of the Committee to the works, and promised to be back for a few hours later in the evening; But he did not return, and I received a report on the following morning that he was again ill in bed; and he has not since been back to the works. On Sunday, when we had our last breakdown, neither the foreman nor the fitter was available. Fortunately, I was on the works at the time and near to the engine when the heavy knocking took place, and had the engine stopped just in time to save the cylinder.

With so much running machinery in the works, it would be necessary to have more than one fitter available in the winter season at least, and all the machines would require to have a stand-by. It is quite evident that the hydraulic engine is being heavily over-taxed, and, as now constructed, is not a sufficient stand-by. The retort-house governors, which should assist materially in keeping a regular pull on the retorts,

and so compensate for any variation in working, have not been working satisfactorily for some time past; and up to the present we have not been able to ascertain from what defect the trouble arises, owing to the plant being on full work. This search can only be made during the summer season. These accidents, and the considerable change in working arising therefrom, demanded very close attention in order to prevent a variation in the quality of the gas and to get a minimum yield of gas from the retorts in action; and owing to the absence of the foreman and mechanic, as before mentioned, this has entailed the constant personal attention on the works of myself on an average of eighteen hours per day during the period since the first breakdown.

The remainder of the parts for renewal of the coal-elevator arrived to-day; and the work of erection is being pushed on as speedily as possible. For pushing the coal we have already a spare pushing machine; but we have only one charging machine—that on the combined charger and discharger. This machine has given very little trouble up to now; but as it is running day and night in the winter season with an interval only from 5 to 15 minutes every two hours, it will be seen that we are incurring considerable risk in not having a stand-by with this machine also. When this machine requires a thorough overhaul, it can only be done in the summer season by resorting to the use of the West machines; and these would take several hours to re-erect and put into action, as there is no room for them standing in position ready for action while the other machines are working the full winter load. The West machines also require coal elevated to be available for work, so that they were of no service to us in the recent occasion.

We have had considerable difficulty in securing a sufficient supply of labour to cope with the extra work arising from the accidents, and even for labour for carrying on the ordinary routine of work. We usually have a few men with a little experience available in the yard for assisting in the retort-house when the full winter load comes on. But this season all the reserve men available for retort work have already been taken into the retort-house in the place of men off duty through illness; and some of the staff who should be on other duties had to be drawn upon to complete the retort-house staff. So the usual work of scurfing the retorts and attending to retort-house repairs cannot be undertaken for want of men; and this work is considerably in arrears. We have at present four men off through illness, and also two men absent without leave; and since the beginning of the year we have had other absentees. These absences from duty might not have been a serious matter in ordinary circumstances, but at present they are very serious.

In the afternoon of yesterday, through the kindness of a neighbouring gas engineer, I secured the services of two men experienced in clearing stopped pipes, to take charge of the gangs on the special work. We are now making progress in getting the pipes cleared; and to-day we have sufficient stock of gas to enable us to return to normal pressure. I hope to make further progress as the day advances; such as will admit of full pressure for the lighting period to-night.

I should perhaps explain that the capacity of the gasholders—a million cubic feet—is equal to the twenty-four hours' mid-winter output; but fully 300,000 cubic feet of this is drawn upon between the hours of dusk and 10 p.m., so that under the most favourable circumstances our reserve at midnight does not exceed sixteen hours' manufacture. Our usual minimum is 250,000 cubic feet of reserve, equal to six hours' manufacture, and our working average gives a reserve equal to about ten hours' manufacture; so that two stoppages of four hours' duration within one week leave us with very little reserve.

STOCKPORT ARBITRATION AWARD.

Settlement of Gas-Workers' Dispute.

At a Meeting of the Stockport Gas Committee held on Oct. 28, it was reported, in connection with the strike of workmen which occurred some time ago, that Mr. Lynden Macassey, K.C., had been appointed by the Board of Trade to examine and adjust the wages of the department, and that he had heard the evidence and arguments on behalf of the Gas Committee on the one hand and the Municipal Employees' Association on the other. The award is now issued.

By an agreement entered into in 1913, between the Gas Committee and representatives of the men, it was provided that if it were shown that better wages were paid to employees of the gas committees of comparable towns than were paid at Stockport, two practical persons should be appointed—one by the Committee and the other for the men—to examine and adjust the wages, so as to bring them, so far as practicable, into conformity with those of the towns adopted for comparison. By a further agreement entered into on Aug. 13 last, it was provided that the first agreement should be read, and have effect, as if the words "one practical person shall be appointed by the Board of Trade, under the provisions of the Conciliation Act, 1896," were substituted for "two practical persons shall be appointed."

At the hearing, the towns of Oldham, Bradford, Bury, Bolton, Manchester, Salford, Burnley, Rochdale, Blackburn, Leeds, Huddersfield, and Halifax were adopted for the purpose of comparison with Stockport. At the time of the hearing, wages for certain classes of men were satisfactory, and no claim was made in respect of them.

The Association claimed that other classes of employees in Stockport should be paid a rate of wages equal to the numerical average of the varying wages paid at the twelve towns adopted for comparison, without reference to the varying circumstances of the work and conditions prevailing at such towns.

The Arbitrator says: "I am unable to adopt this contention of the Union, and have, in fixing the rate of wages to be paid to the different classes of operatives in respect of whom an advance is claimed, considered the rate of wages payable to such class at each of the twelve towns. At the same time, I have had regard to the different conditions prevailing at each such town in regard to employment and work. After full consideration of the circumstances at Stockport and each of the twelve towns adopted for comparison, I order that the following shall be the rate of wages payable to the class of employee mentioned:

Hydraulic men	at the rate of	6¾d. per hour
Exhauster boiler men	,,	4s. 9d. per shift
Coal machine men	,,	7d. per hour
Coke wheelers	,,	4s. 6d. per shift
C.W.G. boiler men	,,	4s. 9d. ,,
Purifiers	,,	6¼d. per hour
Works pipe-fitters, at the existing rate of wages, except that the lowest rate shall be		7d. per hour
instead of		6¾d. ,,
Crane-drivers and telpher men	at the rate of	7d. ,,
Jointers	,,	7¼d. ,,
Labourers	,,	6¼d. ,,
Machine workers	,,	6¾d. ,,
Stove and meter complaint men	,,	7d. ,,
Stove cleaners and repairers	,,	6¼d. ,,
Oilers and greasers	,,	6¾d. ,,
Meter inspectors, at the existing rate of wages, except that the maximum shall be		32s. per week
Lamplighters	at the rate of	27s. 7d. ,,
Gas-fitters	,,	8½d. per hour
Gas-fitters' labourers, starting as improvers:		
16 to 17 years of age	at the rate of	2½d. per hour
17 ,, 18 ,,	,,	3d. ,,
18 ,, 19 ,,	,,	3½d. ,,
19 ,, 20 ,,	,,	4d. ,,
20 ,, 21 ,,	,,	4½d. ,,
After 21 ,,	,,	7d. ,,

Provided there shall be no reduction of the existing rates now paid.

The advances shall be paid as from the first full pay day next after Sept. 13, 1915.

At a meeting of the Gas Committee on Dec. 14, the Gas Engineer (Mr. S. Meunier) submitted a letter from the District Secretary of the Municipal Employees' Association with reference to the stokers' wages, and a number of communications that he had received from different branches of the workmen, stating that their cases had not been dealt with by the Arbitrator's award. The Committee resolved that the writers be informed that the Gas Committee "cannot depart from the terms of settlement; and that any portions of the award which are not satisfactory to them should be referred to the Arbitrator, through the Chief Industrial Commissioner (Sir George Askwith)."

The action of the Gas Committee was approved at a meeting of the Town Council last Wednesday; the Mayor (Mr. T. W. Potts, J.P.) remarking that it was satisfactory to hear the matter was now settled.

PRIVATE OWNERS' WAGGONS.

[From the "Iron and Coal Trades Review."]

The legal position respecting owners' waggons, apart from mineral and some other waggons, is very indistinct. The trader would appear to have no absolute right; and it is the absence of positive obligation which has proved the happy hunting ground of the railway lawyer. Under section 2 of the Traffic Act of 1854, the obligation of affording "reasonable facilities for the receiving, forwarding, and delivering of traffic and for the return of carriages, trucks, and other vehicles" was imposed upon the companies; and this enactment has been rightly regarded as the Magna Charta of the private waggon owner, inasmuch as the use of such waggons might fairly be claimed a reasonable facility. Every trader has the option of sending traffic in private waggons or in waggons supplied by the railway company [*vide* Sir F. Peel in *Harrison and Camm v. Midland Railway Company*, 1892]; and in that same case it was affirmed that, so long as a trader tendered goods in proper vehicles, he was entitled to have goods conveyed in those vehicles to the point of destination. So far so good. But the mere right to run waggons is altogether barren, unless it carries with it some advantages—financial and otherwise—to justify the purchase and the maintenance of the stock; and we are bound to recognize that legislation is sadly deficient on this point, and what is more the enactments in respect of it have been interpreted in a sense hostile to the traders' interest. The difficulty, fortunately, does not apply to traffic in class A, to certain traffics in class B, and to those products for which the companies decline to provide vehicles—viz., creosote, coal tar, gas tar, ammoniacal liquor, &c. In respect of these, the Rates and Charges Orders Confirmation Acts wisely fixed the maximum conveyance, exclusive of the charge for trucks. For other traffic, B to 5, however, the position is distinctly unfair and oppressive. The intention of Parliament was undoubtedly benevolent. Sub-section (*b*) of general condition 2 of the Acts of 1891-2 provides:

> Where, for the conveyance of merchandize *other than merchandize specified in class A of the classification*, the company do not provide trucks, the rate authorized for the conveyance shall be reduced by a sum which, for distances not exceeding 50 miles, shall, in the case of difference between the company and the person liable to pay the charge, be determined by an arbitrator appointed by the Board of Trade, and for distances exceeding 50 miles shall be the charge authorized to be made by the company for the provision of trucks, when not included in the maximum rate for conveyance.

These are:

50 to 75 miles	9d. per ton
76 to 150 miles	1s. per ton
Over 150 miles	1s. 3d. per ton

It will be noticed that this provision applies to traffic "other than in class A," and fixes the abatement. The obvious purport of the section was followed at first; and the meaning was so evident to the railway officials of the time that owners'-waggon rates were fixed in many instances. In fact, even in cases where the rates were exceptional—

below powers—figures were put on the rate-books in some areas with abatements for owners' waggons roughly as follows:

1 to 6 miles . . .	1d.	61 to 80	5d.
7 to 10 ,, . . .	1½d.	81 to 100	6d.
11 to 20 ,, . . .	2d.	101 to 120	7d.
21 to 40 ,, . . .	3d.	121 to 150	8d.
41 to 60 ,, . . .	4d.	151 to 200	9d.

This position, however, was not permitted to remain unchallenged, and traders were continually involved in disputes relative to their abatements, because the railway companies only granted them upon extreme pressure. Nor was the railway lawyer at a loss to find a flaw in the provision. The whole clause might be upset upon the interpretation of the word "provide;" and the opportunity came in 1911, when the Courts held that, so long as the companies were willing to provide trucks, the trader had no claim to a reduction from the tonnage (conveyance) rates under this section. If he claimed to run his own waggons as a "reasonable facility," he must run them for nothing. In consequence of this, the trader's right to use the railway under toll is now confined to class A traffic almost exclusively. The discouragement of the user of private waggons is not, however, confined to questions of rebate. Demurrage plays an equally important part. So far as legislation is concerned, the trader, under condition 6 of the Acts of 1891-2, was put into an identical position with the railways. It enacts that—

> Where merchandize is conveyed in trucks not belonging to the company, the trader shall be entitled to recover from the company a reasonable sum by way of demurrage for the detention of his trucks beyond a reasonable period.

Should he have the temerity to expect this provision to be honoured, he will probably experience immediate disillusionment; and should he go to the excessive cost of a law suit to enforce his claim, he may secure 6d. per day, as did Messrs. Charrington, Sells, Dale, and Co. in their fight with the London and North-Western Railway Company, in 1905, while for specially-constructed vehicles the companies may, as an act of grace, give 1s. per day after a very extended delay. Meanwhile, the companies exact in the reverse direction the following:

> Ordinary waggons, 1s. 6d. per day.
> High-capacity waggons, 2s. to 5s. per day.
> Specially-constructed waggons, 3s. to 10s. per day.

And the Courts which award a trader 6d. per day have no hesitation in supporting the railway companies' claim to 1s. 6d. for identical detention.

AN EXPLOSION AT A BLACKBURN GAS-WORKS.

The members of the Blackburn Town Council had a long and stormy sitting on Thursday; one of the matters dealt with being an explosion which occurred at the Addison Street Gas-Works last month.

Mr. E. PORTER, the local representative of the National Union of Gas Workers and General Labourers, sought to have an inquiry made by a representative Sub-Committee regarding an allegation that the explosion referred to was deliberately caused by the workmen themselves, or, in other words, by someone inside acting in collusion with someone outside. In moving an inquiry into the charge, of the falsity of which he was satisfied, Mr. Porter contended that it ought to be substantiated or withdrawn, as it placed the men under an undeserved stigma. Incidentally he remarked that he knew the man who had caused the explosion—not deliberately or maliciously, as he explained at a later stage of the proceedings—but he demurred to giving the name without certain safeguards. He went on to say that it was only reasonable, having regard to such serious charges, that there should be a full inquiry; for if the explosion was deliberate, it was a despicable act. The allegation was that a certain portion of the water-gas plant had been interfered with; thereby partially wrecking the installation and endangering the lives not only of workmen but of dwellers in the vicinity of the gas-works. The National Union of Gas Workers held the view that no punishment could be too severe for anyone who would stoop so low. On behalf of the men he was authorized to say that they were prepared to go before the Chief Constable of the borough, or anybody else, and give the whole of the evidence in their power.

Alderman NUTTALL, J.P., the Mayor, who is also the Chairman of the Gas Committee, said that as he occupied the latter office he felt compelled to take part in the debate, or to say something. He hoped the Council would vote against the resolution. It was unnecessary to have an inquiry, because Mr. Porter had the information as to who had caused the explosion. He (the speaker) had nothing to withdraw from what was said at the Gas Committee meeting on Dec. 27. It was never stated that the explosion was caused by a workman, though it was said that the explosion was deliberately caused. The Union had issued to their members a pamphlet containing a number of letters that had passed between them; but it would have been better had they published the whole of the letters and not kept back those that did not quite suit them. He then read the following letter addressed by the General Manager of the Gas Department (Mr. A. Morton Fyffe, M.Inst.C.E.) to Mr. J. R. Clynes, M.P., the General Secretary of the Union. This showed clearly that the Gas Committee had dealt with the matter in a straightforward manner:

Dec. 30, 1915.

> Dear Sir,—I am in receipt of yours of the 29th inst., and note what you say regarding the explosion which took place recently at our Addison Street works; and in reply thereto desire most emphatically to state that at no time have I alleged that the explosion was deliberately caused by some act of the workmen. What I have stated, and what I reiterate, is that the explosion was deliberately caused by the safety doors of the plant being tied down; but I have never at any time said that the act was committed by one of the workmen.
>
> The Gas Committee have put the matter in the hands of the police authorities; and if the person who is responsible for the explosion can be found, prosecution will follow.
>
> I would point out that the allegation that the explosion was caused by an act of one of the workmen has been made on behalf of your Union by Mr. Councillor Porter in his letter to me dated Dec. 21, in which he states that he knows how, and why, the explosion took place, and the name of the workman responsible.
>
> With this knowledge in your possession, you are enabled to enlighten the whole position by communicating the information to the Chief Constable of Blackburn, who now has entire charge of the matter.

Mr. PORTER remarked, as he rose to continue the debate, "I hope the Council are now prepared for the details."

The MAYOR, however, drew Mr. Porter's attention to the Standing Orders, and ruled him out of order; stating that, in his reply, he could not introduce new matter, but must confine himself to points raised in the discussion.

Three voted for the resolution and twenty-seven against.

GASHOLDER MISHAP AT HASLINGDEN.

An Effect of the Gale.

An anxious time was experienced by Mr. R. V. S. Houghton, the Engineer and Manager of the Haslingden Union Gas Company, during the gale which swept the country on New Year's Day, and which was the cause of an accident to the Company's No. 2 holder. In that part the storm was a terrific one, with wind travelling at an estimated rate of 100 miles an hour; and the holders, which are situated at the mouth of a valley, were exposed to its full force.

The holder in question is a two-lift telescopic one, about 90 feet diameter, with columns 50 feet high, and having a capacity of some 300,000 cubic feet. Mr. Houghton states that the cause of the accident [which occurred just after half-past five in the afternoon] was in all probability the cross-bars of the counterbalance chain attached to the outer lift, which, blown by the wind, hammered with great force on the guide-rail, eventually causing the fall of 10 feet of this from the top part of the column on to the holder crown below, through which it crashed into the tank. In its passage, this piece of guide-rail—which is 4½ in. by 6 in. T iron, 1 inch thick—pierced a hole, including jags, some 12 inches square, and also bent down and tore for a short distance the adjacent sheet, thus quickly liberating the 90,000 cubic feet or so of gas which the holder contained.

The consequence was that, at a most inconvenient time, a portion of the town was for about 20 minutes deprived of gas. Not a moment was lost, however, by Mr. Houghton in setting to work to put matters straight; the inlet and outlet of the damaged holder being promptly sealed-up, and the whole of the district supplied from No. 1 holder. With the aid of electric hand lamps, an effort was then made to ascertain the extent of the damage; but near approach to the holder was out of the question, a further fall of material being momentarily expected, for "the clash of the cross-bars of the chains supporting the balance-weights of the holder was like a series of huge hammers at work." Mr. Houghton was glad to find at dawn the following morning that only one sheet had been pierced; but as several other guide-rails had become loosened, the services of the fire brigade were requisitioned to lash these rails to the columns. By dint of assiduous work, a local tinsmith and his men succeeded in placing a steel sheet 5 ft. 7 in. by 1 ft. 8 in. over the pierced sheet; and Mr. Houghton had the well-deserved pleasure of seeing the holder again under pressure about half-past four on Sunday—less than 24 hours from the time of the accident. It is Mr. Houghton's wish to place on record his thanks to his Directors, the staff, and all who rendered help in connection with the untoward occurrence.

Belfast Gas Undertaking.

The "Northern Whig" (Belfast), in a comment on the working of the Belfast gas undertaking during 1915, remarks that "a puzzling factor is the merely nominal saving which seems to have been effected in the cost of public lighting by the very drastic reduction which has been made in the volume of street lighting." "Almost half the street lamps—save in one or two very central thoroughfares—were," says the writer, "out of commission during the greater part of the winter of 1914-15. Yet the amount of the saving in gas consumed by the street lamps up to the end of March, 1915, is recorded as £224 on an expenditure of upwards of £10,000. Most people would be glad if they could in their own private concerns increase their lighting in the proportion which the street lighting of 1913-14 bore to that of 1914-15 by an increase in their gas bills of a little over 2 per cent.! Surely the Committee has slipped somewhere in calculating the differentiation." The writer thinks the heavy proportion of oil or water gas seems fated to stay with the Belfast gas consumers. "Oil gas was," he states, worked up to nearly 50 per cent. in one supply—first on the score of saving space, although at the sacrifice of economy; the works being congested, and the oil gas, with coal at normal price, dearer to manufacture than coal gas. Now that the old works are being extended by the purchase of a considerable amount of adjoining property, the heavy proportion of water gas still stays with us on the score of economy; the very high price of coal and the comparatively low price we have been getting for our residuals making the oil gas cheaper than coal gas. The pity is that the amount of labour involved in oil-gas manufacture is so pitifully small compared with what is entailed in coal-gas production." Referring to the reduction by 2d. per 1000 cubic feet in the price of gas in October, 1914, the same authority argues that it was by no means warranted by the profits on the year's working. The subsequent increase of 4d., which took place last August, was, he observes, "a rude awakening from the fool's paradise in which the consuming public had been lulled. The most unsatisfactory part of the business is that almost every consumer complains of inflated gas bills; and many people whose lighting demands are steady and regular declare that their bills are considerably higher now than when gas cost 2s. 6d. per 1000 cubic feet net."

PUBLIC LIGHTING CONTRACTS AND THE WAR.

A Discussion at Reigate.

When the Reigate Town Council met on Monday night of last week, the Highways Committee reported that, as the result of negotiations between the Committee and the Redhill and Reigate Gas Companies and the Electric Lighting Committee, all the parties had agreed that there should be an abatement of £1 6s. per annum for each lamp not lighted, commencing on Oct. 23 last and continuing so long as the lighting restrictions remain in force. The Mayor had had a conference with the Engineer and General Manager of the Redhill Gas Company (Mr. W. H. Bennett), the Chairman of the Electric Lighting Committee, and the Electrical Engineer.

Mr. HANDSCOMB moved that the whole matter be referred back to the Committee, as he thought the proposal needed further consideration—not that there was any doubt as to the ability and honesty of purpose of those who had dealt with the question. He said he would be prepared to accept the assurance that since the conference which had taken place between the parties further information had come to hand which, to his mind, made it necessary for the question to be gone into again. There were approximately 552 lamps ordinarily lighted by gas, of which 544 remained unlighted. The reduction would leave a sum of 34s. per lamp per annum to be paid on 544 lamps, or a total for the year of £925. What would the Council receive for this? Nothing, so far as the convenience and safety of the inhabitants were concerned. In dealing with the matter, it was interesting to know, without precedent in past experience, what was being done by other local authorities. In a borough somewhat like Reigate, no payment was made to the gas company. In another town, no charge was being made. So much for the matter from the point of view of the Council as the lighting authority. It should also be considered from the point of view of the Gas Company. It seemed only reasonable that some payment should be made for standing charges, which must continue, though the public for the time being derived no benefit from the lamps. It was only a question as to the reasonableness of the amount. In their case, they had to pay 34s. per lamp per annum. The highest payment elsewhere that had come under his notice was 13s. 4d. If Reigate were given similar terms, the amount payable per annum would be £362, or £563 less. In another district, it was 5s. 4d.; and on this basis the amount would be £780 less than was agreed upon. In another case it was to be 5s., or £789 less than the terms they were considering. These instances all related to local authorities in Surrey or Kent. He would quote another case, though it was much further afield. He referred to Ipswich, where the sum of 1s. per quarter was to be paid to the Gas Company for lamps not lighted. Though the difference between these sums and their own terms was so startling, he should state they had not been selected as the lowest ascertainable. If there was any other district in which the local authority had been called upon to pay more than the highest he had mentioned—viz., 13s. 4d.—it had not come under his notice. Possibly there were circumstances connected with Reigate which would differentiate it from all the other authorities to which he had referred. It seemed to him he would fail in his duty to the Council if he did not disclose the information in his possession; and he could but think that the Council would fail in their duty to the ratepayers if they did not refer the matter back for consideration.

Mr. WALTER seconded the proposal to refer the matter back.

Alderman BARNES: Are we bound by our contracts?

The MAYOR replied that he should say so. He did not think anyone could complain of the way Mr. Handscomb had brought forward the facts he had adduced; but before they were in a position to determine whether the cases quoted were suitable for comparison with Reigate, they should have before them the respective contracts. On Nov. 9, 1914, they entered into contracts with both Companies. They made what he considered was a favourable contract of £3 per lamp per annum for five years. This contract was entered into largely upon his recommendation. They had to bear in mind that the contract provided, not only for the supply of gas, but for lighting and extinguishing the lamps, and for the painting and repairs. The cost was £3 per lamp, or, reduced to simple figures, 1s. 2d. per lamp per week; and the Gas Companies were ready and willing to fulfil their contracts. It was no fault of theirs that they were not carrying it out. The Companies made the contract in the expectancy of obtaining some reward. The question was, having regard to all the circumstances, whether the difference between 6d. per lamp, which the Companies were prepared to rebate, and 1s. 2d. was sufficient. The 6d. rebate was a higher sum than he expected to obtain when he went into conference with the other parties; and it was a higher sum than the Town Clerk expected to obtain. They must not forget what were the standing charges—such as the decay of mantles and broken glasses, which were always more when the lamps were not lighted. There had been a great increase in the cost of glass. The Gas Companies met the Corporation very well indeed. He did not think they could expect them to make sacrifices, when there was no compulsion upon them to do so. They could come forward and ask the Corporation to carry out the contract; and without having the contracts of the other authorities before them, no useful purpose would be served by referring the matter back.

Mr. HANDSCOMB: Was any information obtained or at hand when you met the Gas Companies?

The MAYOR: No.

Several members having supported the motion, the whole matter was referred back for further consideration.

On behalf of the Mannesmann Tube Company and the United Tube Corporation, representations have been made to the Newport (Mon.) Corporation that the United Tube Corporation are entirely British, are controlled by Messrs. Baldwins, Limited, and are formed to carry out part of the original scheme of the Mannesmann Company, and, with the latter Company, are at present controlled by the Government, and are employing only British labour. The United Tube Corporation intend to expend about £50,000 in plant and machinery for carrying on the work.

GERMANY'S SUPPLIES OF NITRIC ACID.

[From the "TIMES."]

Interesting information arising out of the correspondence on the supply of nitrogen * and the possible diversion to the enemy of British exports of sulphate of ammonia was furnished to the "Times" with regard to Germany's ability to obtain supplies of nitric acid by synthetic processes from her own internal resources. Nitrogen and nitric acid are, of course, essential to the manufacture of high explosives.

The statement in a letter from Mr. D. Milne Watson (Chairman of the Sulphate of Ammonia Association) that the Badische Anilin Company now claim to be producing sulphate of ammonia at the rate of 300,000 tons a year, and that "in view of the increase in the production of cyanamide in Germany it seems more than probable that the German claim that they are independent of nitrogen from outside sources is correct," was discussed by Mr. A. E. Barton (Chairman of the Alby United Carbide Factories, Limited, and Nitrogen Products, Limited). Mr. Barton, who has just returned from a visit to Norway and Sweden, pointed out that the Badische Company's output of synthetic ammonia, which before the war was turned into sulphate, was 150,000 tons a year. There had undoubtedly been an increase; and he learned while in Scandinavia that this increase was about 200,000 tons, and that nitric acid was being produced by the use of synthetic ammonia. This, together with the output of certain smaller works producing nitric acid synthetically from gas liquor, was the chief source of Germany's nitric acid supply. If it were not for the Badische output, the supply of nitric acid would probably have given out long ago, as much must have been used up while the Badische Company were perfecting their synthetic process, which was not available before the war.

With regard to the future, Mr. Barton stated that he was informed that Dr. Caro, the inventor of the Frank Caro process of producing cyanamide, in conjunction with the Deutsche Bank, and backed by the Government, is installing at Bitterfeld, in Westphalia, a producer gas-power plant of 10,000 H.P. to make carbide of calcium, which can be turned into cyanamide, and the ammonia taken from this for the production of nitric acid by the synthetic process. It will apparently be possible to get ammonia as well as cyanamide from the producer-gas plant; and the result is expected to be the production of 200,000 tons of concentrated nitric acid per annum. In addition, there is another factory controlled by Caro and the Deutsche Bank, in Bavaria, producing about 30,000 tons of cyanamide, and the Knapsack works near Cologne producing some 15,000 tons also available, if necessary, for the manufacture of nitric acid. The new Caro plant was to have been running in January; but it is understood that there has been delay, and that it may not be ready for some time. Mr. Barton expressed the view that it is not necessary for Germany to get outside supplies to produce nitric acid, as there is enough ammonia available in the country for the purpose.

A fact for which business men who have visited Scandinavia vouch is that deliveries of machinery "to private order" are now being made to neutral countries from Germany. This would seem to indicate that the supplies of war munitions and materials are now such that owners of machinery works which were commandeered at the beginning of the war are being allowed to complete their private work and export machinery to neutral countries, which they were unable to do in the earlier stages of the war.

GAS LIGHTS A HUNDRED YEARS AGO.

Our attention has recently been directed to an article entitled "Process of Procuring Gas Lights," that appeared in the number of the "European Magazine" for January, 1816—just a century ago. The author is not named—the article being merely concluded by a "Z," and the date named. It will be interesting to reproduce it in its entirety.

This truly valuable modern discovery, now matured and brought to perfection by the combined efforts of several persevering individuals, stands pre-eminently conspicuous, whether considered in a domestic or national point of view, producing from smoke and refuse coal the most agreeable, silvery, and incomparable light, combined with the most powerful heat, whereby the interiors of shops and dwellings are rendered nearly as light as at noon-day, and the public streets and squares much more safe and convenient, even by one-fourth in number of lights, than by the common oil-lamps, which latter, by comparison, appear more imperfect and insufficient than ever.

This gaseous fluid is extracted by distillation; and the process I shall endeavour to render comprehensive to my readers.

A number of square cast-iron ovens, called retorts, are ranged, and fixed horizontally in brickwork, with flues passing under and over them. About a bushel of small coals is put into each; the doors are then screwed very tight, and secured by luting.

By external fires the retorts are kept intensely hot for the space of four or five hours, when the coke is taken out, and a fresh charge introduced, in which operation it is interesting to witness the effect—the door being unscrewed, the admission of atmospheric air causes ignition, and a very considerable report. This report can be almost destroyed by applying a light at the instant the door is opened.

From the upper side of each retort, a vertical, or rather syphon-like, pipe receives the gas and smoke in its gross state—with which, likewise, passes a portion of tar and ammonia into a larger horizontal pipe elevated, and thence continued, somewhat diminished, in an inclined direction, and immersed in troughs filled with water for the purpose of condensing it, to the chemical and purifying vessels, which are of cast iron, very large, and three in number. In the first of them is deposited the tar and ammonia—two products probably much

* See "JOURNAL" for Dec. 28, p. 717, and Jan. 4, p. 43.

over-rated in value. The utility of the latter is certainly not yet fully ascertained.

The gas disengaged now passes over by a double syphon-like pipe, partly immersed in water (condensing a quantity of essential oil, which passes into a receiver), into the second vessel, which contains a fluid composed of certain proportions of water and lime—in passing through which it deposits its sooty and sulphurous qualities. Again disengaged, it undergoes a second similar process in the third vessel; and now become transparent, the volatile fluid is conducted through another quantity of water, under the gasometers, in a distinct building.

The gasometers are immense vessels formed of plate iron closely riveted, suspended each by a strong chain, bottom upwards, which chain passes over two wheels, of large diameter, fixed in the strongly framed roof of the building, and kept nearly in equilibrium by ponderous weights at the other end of the chain. The shape of the gasometer is circular, on an oblong square—and some of those already formed will contain 25,000 cubic feet, and weigh nearly 10 tons.

Each gasometer rises and falls in a tank, somewhat larger, and of the same depth, filled with water. As the gas accumulates from the purifying vessels, it lifts up a certain weight or proportion of the gasometer, regulated by the equipoise, and which weight or pressure is necessary to give the required impetus, to force the gas into a larger outlet main pipe, likewise under the gasometer (the mouth standing a few inches above the water), which conveys it into the streets, and thence by smaller pipes into the houses.

As the gas diminishes in quantity, the gasometer sinks; and when nearly exhausted, care is taken to open the cock of the second, which if neglected, as has sometimes happened, all the lights are instantaneously extinguished. By this ingenious mechanism, no danger of explosion can be apprehended; for when the gasometer is raised to its greatest elevation, and can hold no more, the surplus quantity of gas finds vent through the surface of the water, under the mouth or rim of the gasometer.

The apprehension generally entertained of the explosion of gas is certainly not well founded; for, like water, it is equally under command. If conveyed in sound pipes, and directed by safe cocks, no danger can possibly happen. On the contrary, if the pipe, tube, or cock, should prove unsound, the gas would escape, and the room would soon become intolerable from the noxious effluvia—then by shutting the main cock, the cause would be removed. So, in like manner, when a water-pipe proves defective, feeling the inconvenience, we very naturally endeavour to shut off the water till the pipe can be repaired.

In the event of the breaking of the chain (more particularly liable in frosty weather), I certainly anticipate some unpleasant consequences. For the additional sudden pressure acting upon the gas, would probably impel the flame of every light to elongate very considerably; and if not immediately observed and counteracted by each commanding cock, might otherwise prove injurious.

I think it necessary to mention this circumstance, to prevent as much as possible the consequent alarm—bearing in mind the old proverb, that "prevention is better than cure." Hence the necessity of keeping anything combustible as far from the light as possible.

The quantity of gas daily prepared for a thousand lights, in the dark winter months, is immense, and, probably, far exceeding the calculations erroneously formed by experimental theorists. Hence arises the incompetency of the present establishments to increase, at present, the number of lights, and the consequent disappointment to the public desirous of being supplied, as likewise to the shareholder—doubtless deceived by the too sanguine prospects of wealth held out by the original projectors, and still continued by interested individuals, which, like many other speculations, so prolific of late years, has already decided by practice the fallacy of theory, as will be more particularly experienced in water-works, and, I fear, gas-light schemes.

To introduce the use of gas generally into shops, squares, and principal streets, the stations for the manufacture of it must be increased, both in number and magnitude, with the corresponding machinery and apparatus, and which are of the most expensive nature imaginable. The heavy disbursements in the first formation, and the casual and permanent expense of conducting such concerns, cannot, I am well convinced, be supported or maintained by the present inadequate rate of supply.

The coke produced, if not so valuable as coal, is certainly useful, and applicable to various purposes. The consumption of coke should be promoted by every individual interested, or wishing success to a useful discovery—so conducive to the interests and convenience of the community. It keeps a steady and clear fire, emits little smoke, therefore well adapted for bright stoves, and for chimneys inclined to smoke by particular winds; and will, in some degree, diminish the frequent necessity of sweeping chimneys.

The employment hereby given to a vast number of workmen, particularly in iron, copper, and brass, is deserving of particular mention, and has certainly proved a national advantage, in the stagnation of our commerce and trade.

The many beautiful and ingenious productions, in brass-work, now exhibited in the shops to show the lights to the best advantage, do great credit to the artists, and forms a new era in that particular branch of business.

Cardiff Water Supply.—The Cardiff Water Engineer (Mr. C. H. Priestley) has reported on the desirability of making provision for supplementing the supply of water from the Taff Fawr, not only when a drought is severely felt, but also when desirable at the commencement of a dry season. Last summer it was thought necessary to commence pumping from the Eley; and the cost of pumping $7\frac{3}{4}$ million gallons for the town supply was £180. Mr. Priestley considers that it should be possible, even during drought, to pump from $1\frac{1}{4}$ to $1\frac{1}{2}$ million gallons per day; but this can only be guaranteed by having water from the Eley available when necessary. He suggests the utilization of existing pumping plant as far as possible; and it has been decided to adopt this course.

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Showroom Specialists for the Gas Industry

NOTES FROM SCOTLAND.

A Sudden Death in Edinburgh.—A painful sensation was created on Friday last in the Treasurer's Department of the Edinburgh and Leith Gas Commissioners by the sudden death of a member of the staff—Mr. David Dingwall. He arrived at the office, apparently in his usual robust health, but later in the morning complained of pain in the chest. Thinking a little fresh air would do him good, he left the office for a stroll. An hour had not passed before a telephone message was received from the police intimating that a body had been brought into the mortuary, and that in one of the pockets of the deceased's clothes was an envelope bearing the address "Gas Office, Edinburgh." Five years ago Mr. Dingwall met with a severe accident when motor cycling; and it is probable that this may have left some unsuspected weakness. He was 34 years of age, and unmarried.

Paisley Wages Increase.—The finding of the Board of Trade, to whom was referred the dispute between the retort-house workers in the Paisley Gas-Works and the Corporation, with regard to an increase of wages, has been issued. The Board recommend that the wages of the men concerned should be advanced by a further 2d. per shift, such advance to come into operation as from the beginning of the first full pay week following Dec. 17, and to be regarded as war wages, and to be recognized as due to, and dependent upon, the existence of the abnormal conditions now prevailing in consequence of the war.

Perth Gas-Works Mishap.—Last week hand stoking had temporarily to be resorted to in consequence of a breakdown in connection with the coal-handling plant at the Perth Gas-Works. With existing heavy demands, some difficulty was naturally found in maintaining a full supply of gas; and pending the putting in order of the mechanical arrangements, consumers were asked not to use gas for cooking and heating purposes, so as to conserve the supply to meet lighting requirements. Steps to have the necessary repairs executed with all possible speed were, of course, taken by Mr. David Vass (the Gas Manager). At a subsequent meeting of the Gas Committee, ex-Bailie Wright (the Convener) stated that the main cause of the present unsatisfactory position was the non-delivery of plant which had been under contract to replace a section of the stoking plant that had become worn out—the delay being caused through the works of the contractors having been taken over by the Government for munition work. It was expected that the renewals would have been made in the summer time. The defects which had recently occurred had now been remedied; and it was anticipated that there would be no further difficulty. He regretted that a breakdown should have occurred at this juncture, when the consumption of gas was at its maximum. The Committee agreed to ask Mr. Vass to submit a report in writing. [Since the above was in type, the text of Mr. Vass's report has been received, and is referred to elsewhere, p. 98.]

Gas-Furnaces in Glasgow.—Special attention is being devoted by the Glasgow Corporation Gas Department to the installation of gas-furnaces for annealing, tempering, and case-hardening, bolt and rivet making, and heating, shell nosing, shell banding, &c. All kinds of gas-heated furnaces are shown in the demonstration hall at the Gas Department workshops. The furnaces on view include types for melting copper, gun metal, brass, aluminium, &c., and drying ovens for japanning, lacquering, and similar work.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 10.

A certain amount of business is being done in pitch; and with a little help from shipowners, good business might be possible. The present values range from 19s. to 19s. 6d. per ton net, at makers' works. Other values are: Creosote, 4⅛d. to 4¼d. per gallon in bulk; 90-160 solvent naphtha, 2s. 2d. per gallon naked; pure toluol, 3s. 4½d. per gallon naked—all at makers' works, net cash.

The demand for sulphate of ammonia still continues good, and values are very firm; £17 5s. per ton net into buyers' bags at makers' works being reported as having been paid for 25 per cent. quality for the first six months of this year.

Tar Products in the Provinces.

Jan. 10.

There is no alteration in the markets for tar products. Pitch is still quiet, and business is difficult to negotiate. The price of creosote remains the same. Heavy and light naphthas are in good demand.

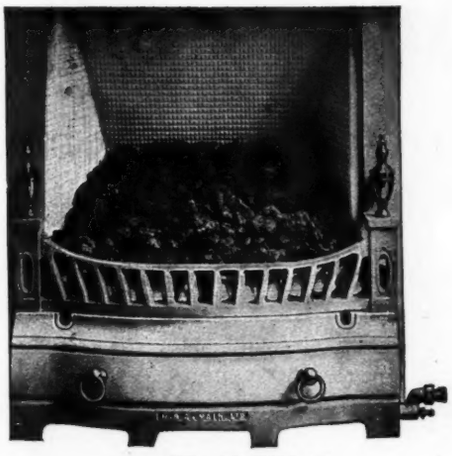
The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. 1d. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 2⅝d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 5d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Jan.* 8.

Although the number of transactions recorded this week has been comparatively small, the tone of the market has not diminished in vigour, and higher prices have again been paid at all points. At the close, the tendency is still upwards, and the nearest prompt values are £17 12s. 6d. per ton f.o.b. Hull, £17 17s. 6d. f.o.b. Liverpool, and

THE MAIN GAS FIRES.



The ST. NICHOLAS.

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ST. NICHOLAS—

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The new booklet—"Main Reflections"—contains particulars of several new Gas Fires. Copies free on application.

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WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

£18 2s. 6d. f.o.b. Leith. For future delivery the attitude of producers has hindered business, and no first-hand sales have been reported; but it has transpired that middlemen have accepted a premium of 2s. 6d. to 5s. per ton on prompt prices for February-April shipment.

Nitrate of Soda.

This market is firmer on spot, and quotations have been advanced to 15s. 9d. per cwt. for ordinary, and 16s. 9d. for refined quality.

Sulphate of Ammonia.

From another source, it is stated that there has been little alteration in the market for this article during the past week, and not much fresh business has been reported. Outside London, makes are quoted at £17; Hull, £17 12s. 6d. to £17 15s.; Liverpool, £17 15s. to £17 17s. 6d.; Leith, £17 17s. 6d. to £18; Middlesbrough, £17 15s. to £17 17s. 6d.

[From S. W. Royse and Co.'s "Manchester Chemical Trade Review" for 1915.]

Tar Products.—Benzols were active; the full production being taken up readily, and supplies for motor purposes had to be refused. 50-90 was steady throughout at 1s. 5d.; and 90, after commencing at 9d., was steady at about 11½d. since June. Solvent naphtha had a good year—advancing steadily from 9½d. per gallon to 2s.; and the market is strong at present. Creosote fell from 3¼d. in January to 2⅜d. in July, and has since been steady. Production was heavy; and home consumption and export were less than usual. Shipments of creosote, tar oil, &c., during the eleven months of 1913 and 1915 were 34,495,414 gallons and 31,356,347 gallons respectively. Crystal carbolic makers were extremely busy—their full make being taken up at steady prices. Crude carbolic advanced from 3s. in January to 3s. 7d. in May, and has since been quite steady. Liquid carbolic acid has been continuously active; advancing from 1s. 3d. to 2s. 8d. per gallon. Pitch fell from 22s. 6d. to 17s. It did not lose much in the early months, but later had quite given way. The home demand was below normal, and export trade poor—the quantities during the eleven months of 1913 and 1915 being 434,179 tons and 233,214 tons respectively.

Sulphate of Ammonia was £11 17s. 6d. in January and £14 15s. in August, since when it advanced rapidly to £18, and is a strong market—a decreased supply of vitriol accounting largely for this. There is a good inquiry, both home and abroad. Exports during the eleven months of 1913 and 1915 were (respectively) 295,930 tons, value £4,031,918, and 278,520 tons, value £3,733,520.

It was reported to a meeting of the Colchester Town Council that the County Council had authorized the expenditure of £500 in opposing the Colchester Gas Company's Bill. The opposition will be formal; but it is pointed out that the county has jurisdiction over Colchester, so far as main roads are concerned.

COAL TRADE REPORT.

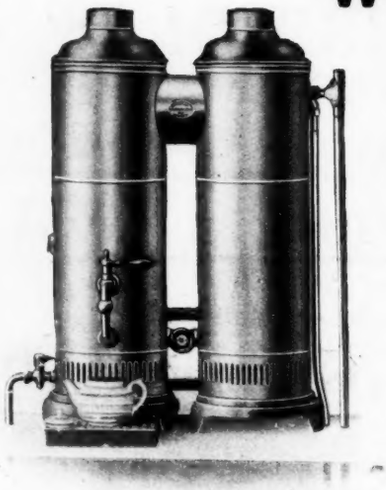
Northern Coal Trade.

The northern coal trade shows a strong demand. With much of the output taken up by contracts, there is some scarcity of fuel for ready delivery—indeed, many of the chief collieries are fully booked up to the end of the month, if steamers arrive in due course. In the steam coal trade, the prices seem to be fairly held; and the inquiry is very full for this time of the year. Best Northumbrian steams are from 23s. to 24s. 6d. per ton f.o.b.; and second-class steams are 20s. to 21s. per ton. Steam smalls vary from 10s. to 12s. 6d. per ton, according to quality, and with a steady demand. The gas coal trade is active, and the fuller output is readily taken up—in many cases to replenish stocks that were lessened in the holidays. Best Durham gas coals are from 22s. to 22s. 6d. per ton f.o.b.; second-class gas coals are 20s. to 21s. per ton; and "Wear Specials" are 23s. to 23s. 6d. per ton. There is still a high rate of freight quoted—23s. per ton having been paid, Tyne to Dunkirk. To Genoa, gas coal is about 22s. per ton for coal, and 7os. for freight. Contracts, however, often modify these figures; so that forward transactions are few. The stormy weather, too, delays steamers and makes the prompt market irregular in some cases, though the tone is on the whole strong, except where such delay causes an occasional ease in the price. Coke is firm; the exports having been heavier of late. Good gas coke is from 28s. to 30s. per ton f.o.b. in the Tyne. There are some advances in the local price of gas coke inland.

Bilston Gas Company.

Moving the adoption of the report and balance-sheet at the annual meeting, the Chairman (Mr. H. Holcroft) pointed out that the accounts were now under war conditions. Like most people, the Company had had their difficulties and troubles to face; but on the whole they had maintained their position fairly well. The sales of gas, in spite of adverse conditions, were approximately the same as they were in the previous year. Residuals, however, showed a considerable drop. The most serious item was the scarcity and the high price of coal. This had given much anxiety; but he thought he had been fairly successful in getting adequate supplies. They were not feeling the full increase in the price of coal in the present accounts because of the existence of old contracts, which, however, had now run out. The Directors hoped it might not be necessary to increase the price of gas. So far they had raised the charge only 3d. per 1000 cubic feet. They felt strongly that the lower in price they could keep the gas, the better it would be for the Company and for the district. It had been represented to him that, by extracting toluol from the gas, the Directors were not only depreciating the gas, but were getting a handsome profit at the expense of the consumers. This was far from the fact. It was a patriotic act on the Company's part, and not done for profit.

Mess Rooms, Canteens, Works Kitchens, etc.



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Academy Street, WARRINGTON. 132, Queen Victoria Street, E.C.

Toluol and Ilkeston's Losses.

It was complained at a meeting of the Ilkeston Town Council last Tuesday, that the borough were having to pay somewhat dearly for their patriotism. The Mayor (Mr. J. A. Macdonald, J.P.), in moving the confirmation of the minutes of the Gas Committee, of which he is Chairman, explained that a communication had been received from the Department of the Minister of Munitions, stating that the Ilkeston Corporation had succeeded in improving the toluol contents of the tar at the gas-works; the percentage of toluol now furnished being most valuable. The Town Clerk had completed arrangements whereby the whole question of the effect of present Government demands on gas undertakings would be considered by the Association of Municipal Corporations, with a view to conjoint action being taken. As a result of carrying out the order, in their loyal desire to help the authorities, Ilkeston had already lost £500 upon the sale of tar. In addition, so as to improve the toluol, they had not obtained the same amount of gas, and were thus losing a further £200 a year. Naphthalene troubles had also been experienced; and he estimated the cost of extra labour involved at £100. So that they were losing anything up to £800 a year, which was considerable having regard to the size of the undertaking. It was their duty to carry out the orders which had been officially issued. At the same time, he hoped the Government would recognize that they had a sound claim on national funds for recompense for what they had lost. The Committee's report was adopted.

Electric Light Failure in Leeds.—Much inconvenience, reports state, was caused on Monday of last week to Leeds shopkeepers whose premises are in the neighbourhood of the junction of Briggate and Upperhead Row, by a breakdown of one of the cables supplying electric light to their establishments. A fault in the main was discovered about 2 o'clock in the afternoon; and a body of workmen was thereafter engaged for some hours in trying to locate it. Light continued to be given up to 5 o'clock; but from that hour the current failed totally, and business had to be conducted by candle light up to the time of closing. About twenty shops were affected.

Gas Supply Difficulties at Chard.—At a meeting of the Chard Town Council last Tuesday, the Gas Committee recommended the installation of Horstmann clockwork controllers for the public lamps, discarding the pressure system now in use. It was complained that a certain factory was allowed to have a supply of gas when its electric supply failed, and that this was done presumably at the expense of the streets. Alderman Fowler explained that, had the gas not been allowed to the factory, the employees would have been prevented from working. It was also stated that the Gas Manager (Mr. A. J. S. White) had had to help with the stoking, owing to the shortage of men. At one time three men only were employed at the works; and the supply was stored up in order that the townspeople should have enough gas to cook their dinners. The report was adopted.

Quality of the Gas Supply at Exeter.

At a meeting last Tuesday of the Exeter City Council, Mr. Gayton called for a return of the illuminating power of the gas in the city. He said he was convinced that the public were not being fairly dealt with by the Company, more particularly those who used prepayment meters. He had noticed for some time that the gas given for 1d. had been lessened, and that the heating power had decreased. He did not think people objected to paying extra for the gas, if the heating power or pressure was equal to what it was before the war. Alderman Varwell said the Company kept as little above the standard of 14-candle power as possible. It was a low standard, but was fixed by Act of Parliament at a time when Exeter was proposing to buy the works. The Town Clerk explained that there was no statutory power as to the calorific value of the gas, though this was more important than illuminating power. When the Council opposed the Company's Bill in the House of Commons three or four years ago, this question was thoroughly threshed out in the Committee-room; but there were difficulties in the way of fixing a minimum. A communication had been received from the Minister of Munitions to the effect that, as gas companies were producing large quantities of toluol, some changes in the manufacture of gas were necessary, which diminished the illuminating power. Local authorities were, therefore, requested not to be too exacting upon gas companies about the preservation of the statutory minimum. The time was inopportune to press the Company for an increased standard, or even the preservation of the present standard. The motion was withdrawn.

The Increase in Price at Elland.—It was stated in last week's "JOURNAL" that the Elland-cum-Greetland Gas Company had increased the price of gas 4d. per 1000 cubic feet, making it 2s. 10d. The price is advanced 4d.; but this brings the charge up to only 2s. 8d. per 1000 cubic feet.

Leeds Action on a Suggestion from the Mint.—The Leeds Gas Committee have decided to give a bonus of 2d. per meter to inspectors on all automatic gas-meters that they clear over and above their normal day's work. This is in consequence of a suggestion from the Master of the Royal Mint that the meters should be cleared at more frequent intervals, with a view to the coin being returned into active circulation as speedily as possible.

Increased Gas Charges at Kendal.—The price of gas to private consumers having been increased, the Gas Committee have recommended the Kendal Town Council to raise the price chargeable against the Lighting Committee, on the following revised method: The number of hours for lighting street-lamps according to the time table at present in force being 3222, any reduction in the number of hours of actual lighting shall be credited to the Committee at the rate of 0·135d. per point per hour. The annual charge per point of light shall be 36s. per annum for the full period of 3222 hours; being at the rate of 2s. 6d. per 1000 cubic feet.

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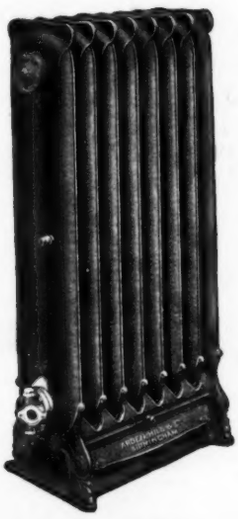

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These Radiators are quickly and cheaply installed and as easily removed, and are therefore specially suitable for heating temporary buildings.

ON HIRE WITH MANY IMPORTANT GAS UNDERTAKINGS.

ARDEN HILL & CO.,
Acme Works, Birmingham.

Gas-Engine Manufacturers and War Munitions.—At the Manchester Munitions Tribunal last Wednesday, a workman who stated that he was employed by a firm making gas-engines, applied for a certificate, on the ground that it had been unreasonably withheld. The employee stated that at the present time he was engaged in making engine-beds; and he wanted employment on war munitions. The firm were not represented; and the Chairman granted the certificate.

Alleged Tampering with Water-Works Machinery.—At a meeting of the Lathom and Burscough Urban District Council, allegations were made regarding supposed tampering with the Council's water-works. Mr. Studdart, in moving that mechanical experts be engaged to investigate the causes of constant breakdowns in the machinery at the water-works, and that no person be allowed at the works without signing the visitors' book and stating the reason for his presence, said that the number of breakdowns in the past twelve months demanded serious inquiry. He believed there was outside tampering with the works, and that there had been men there other than their own men. He wanted a military or police guard. The motion was unanimously carried.

Joint Tar Distilling Plants.—The "American Gaslight Journal" of the 27th ult. referred to the fact that English gas men are seriously considering the project of organizing two or three joint tar-treating plants, to handle the tar from neighbonring gas-works, as they seem to think that the tar-distilling concerns do not give them fair treatment, and that a co-operative plant to dehydrate, and perhaps distil, tar, would be profitable for the smaller undertakings. After mentioning that in Germany, most of the smaller gas-works are members of the Verband Deutscher Gas Fabriken, which has plants to treat tar and ammonia at several central points, and handle all the residuals of the member companies, our contemporary says: "A similar scheme here, or some other way to make a market for the small producer of tar, should be able to find a place in the industry."

High-Pressure in the Birmingham Gas Department.—In a message from the Birmingham Gas Committee to the employees, through the columns of the Department's Magazine, Sir Hallewell Rogers (the Chairman) says: "The year 1915 will be remembered by all of us as a particularly difficult and anxious one. The exceptional demand for gas, especially for munition purposes, and the shortage of labour, created additional responsibility for the various staffs, and necessitated increased vigilance and attention to duty on the part of every man. The output of gas by the department during the year has been increased by approximately 12½ per cent.; and bearing in mind that nearly 800 members of the department are now nobly serving their King and country in H.M. forces, the Committee realize that the progress and efficiency of the Department during the past year is due in no small measure to the painstaking manner in which the members of both the permanent and temporary staffs at the works and in the offices have worked. In addition to the 800 employees who are serving in the active forces, 650 men of military age have been attested in the army reserve."

Increase in Price at Hastings.—The Hastings and St. Leonards Gas Company give notice that the price of gas will be increased 3d. per 1000 cubic feet as from the current ordinary meter readings. In making the intimation, Mr. C. F. Botley (the Engineer and General Manager) says it will be understood that this alteration, "affecting, as it does, under the sliding-scale, both consumers and shareholders, is necessitated by the continued and unfortunate development of adverse conditions directly due to the war."

Dilatory Workers Fined.—Fines of 10s. each have been imposed by the Huddersfield Munitions Tribunal upon five fitters employed by Messrs. W. C. Holmes and Co., for leaving work at 8.50 a.m. on Dec. 29, and not returning until the following morning. The men at first said they left work because the shop was cold; but later they expressed their regret for what they had done, and said they did not realize the seriousness of impeding Government work. It was stated that the firm were engaged in making valves for British Dyes Limited.

Street Lighting at Shrewsbury.—Reductions in street lighting have already been made, with the result that the cost of lighting at Shrewsbury is £825 less; but a Special Committee appointed to suggest further means of economizing on town expenditure suggested that all street-lamps (gas and electric) should be extinguished at midnight—thus effecting a further saving of £376. When, however, the proposal came before the Council, it was withdrawn in favour of a motion that the lights should be extinguished at midnight for a month, as a test. This was defeated, so matters remain as at present.

Electricity v. Gas at Ilkeston.—In the course of discussion at last Tuesday's meeting of the Ilkeston Town Council, the Mayor said the municipal electricity undertaking had never paid—£10,000 having already been lost. Mr. E. Smith observed that the Mayor (who is Chairman of the Gas Committee) had promised them inestimable blessings from the work of the Committee, and, of course, he wanted to carry out his promise; but he was going too far when he attempted to veto what the Electricity Committee had done. The fact remains, however, that, while the tramways and electricity undertakings have proved unmistakable "white elephants," the gas concern, despite the disaster which occurred a few years ago, remains the only sound branch of remunerative municipal work in the town.

Lincoln Gas-Works and Coke Supply.—Complaint was made at the last meeting of the Lincoln City Council of the discontinuance by the Gas Committee of the practice of selling coke in small quantities to people calling for it at the works; Mr. Taylor asking if there was any real reason why the old system should not be reverted to. Alderman Wallis (the Chairman of the Committee), explained that, owing to the great quantity required by firms making munitions of war, there was comparatively little coke otherwise to be disposed of. They were doing their best to supply the bakers, and also sending a little out of the city to those who were their best customers in normal times. While reminding the Council that the gas undertaking was a commercial concern, he promised the Committee would do their best to meet the requirements of the poor.

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MANCHESTER.

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New Acid Concentration Plant at Manchester.—The Manchester Gas Committee have, the "Chemical Trade Journal" reports, entered into an agreement for the sale to the Ministry of Munitions of the concentrated sulphuric acid produced at the Bradford Road Gas-Works; and contracts have been placed for the supply and erection of three units of acid concentration plant at the works.

Metropolitan Water Board Deficiency.—At the last meeting of the London County Council, Mr. Meinertzhagen, answering a question from Mr. Gilbert, said the Metropolitan Water Board deficiency for the year 1914-15 was £94,873; and the estimated deficiency for the current year was £145,130. About four-fifths of the deficiency fell upon the ratepayers of London; and the amount for 1914-15 was equivalent to a rate of about 0·4d. in the pound.

Sidmouth Gas Undertaking.—At the last meeting of the Sidmouth Urban District Council, it was reported that the Gas Committee had received from the Local Government Board sanction to the raising of the further sum of £987 expended on the purchase of meters, cookers, mains, services, piping, and fittings for the prepayment installations. The Committee recommended that the Council contribute to, and become members of, the Sulphate of Ammonia Association; and that the salary of the Gas Manager (Mr. H. Burgess) be increased, and that he be granted a bonus for his services in connection with the extra work carried out last year, occasioned by the various extensions. These recommendations were approved.

Lighting of Bath.—Owing to Bath's situation, it has been found unnecessary to restrict the street lighting on military grounds; but recently the Corporation decided upon an economical scheme, by reducing the lighting at midnight. Arising out of this decision, at the last meeting of the Surveying Committee, the Chairman (Mr. A. W. Wills) submitted for formal record a communication from the Bath Gas Company giving the terms of the new contract. The restrictions reduce the cost of each single lamp by 12s.—£1 2s. each per year, as against £1 14s. formerly. Upon the proposition of Mr. W. J. Baker, the Chairman was heartily thanked for the trouble he had taken in the matter, and the Gas Company for the fair manner in which they had met the Committee.

Coal Supply Difficulties at Lymm and Warrington.—Several gas undertakings in Lancashire and Cheshire are experiencing serious difficulty owing to the shortage of coal. Last week, the Lymm District Council approved a resolution of the Gas Committee (passed a week earlier) that no new gas fires, cookers, or connections be supplied during the war, owing to the shortage of coal. The Warrington Corporation Gas Department have issued a notice to gas and coke consumers stating that, owing to the same cause, it may be necessary to reduce the supply of gas. At their last meeting the Gas Committee passed a resolution that "customers be only supplied, so far as possible, with quantities similar to their previous requirements, as taken upon the average of the quantities of coke supplied to them during the last five years."

Rise in Price at Kingston.—Increases in expenses in various directions, including freight charges and the cost of coal, oil, and other materials, have compelled the Directors of the Kingston-on-Thames Gas Company to notify an addition of 3d. per 1000 cubic feet to the charge for gas, making the price 3s. 1d. Previous to March last, the price of gas supplied by the Company had remained for a considerable period at 2s. 6d. per 1000 cubic feet; but at that date it was found necessary to raise it to 2s. 10d.

Morley Gas Undertaking.—The abstract of accounts of the Morley Corporation for the year ended March 31 last, just issued, shows that the income of the Gas Department was £20,505, and the expenditure £22,280; leaving a deficiency on the year of £1775. The main causes of the deficiency were the increased cost of coal and the transference of £500 to the district rate. Among the expenditure, coal accounted for £8572, purifying £169, carbonizing £1650, and repairs to works £734. Grants to employees totalled £26.

War Bonuses at Croydon.—The Directors of the Croydon Gas Company have decided that the war bonus hitherto paid shall be increased to the following scale: On wages of workmen earning not over 18s. per week, 1s. 6d.; over 18s. but not over 30s., 4s. 6d.; and over 30s. per week, 3s. The rates of wages will be taken at the normal weekly rates of pay, without overtime, and without deductions for funds, &c. No man earning 30s. or less, without bonus, will receive more than 33s. in all. On salaries not exceeding £100 per annum before deduction for funds, &c., 7½ per cent.; and exceeding £100 but not exceeding £200, 5 per cent.

Price of Gas at Darlington.—A motion to reduce the price of gas was defeated at last Thursday's meeting of the Darlington Town Council. The motion was to the effect that the price should be lowered by not less than 3d. per 1000 feet to ordinary and slot-meter consumers. Mr. Best, the mover, said the price had been advanced 33⅓ per cent., and the quality reduced 50 per cent. Mr. Dixon (the Chairman of the Gas Committee) pointed out that the Committee were waiting for the figures to be made up to March 31, and for the fixing of new contracts, before re-considering the question of the charge to consumers. The majority against the motion was overwhelming.

Workman "Gassed" at a Munition Factory.—A lengthy inquiry was made by the Manchester City Coroner into the circumstances of the death of Henry Grave, who was "gassed" at Messrs. Armstrong, Whitworth, and Co.'s Openshaw works. Deceased was a hydraulic power house engine attendant, and had on several occasions complained of a strong smell of gas in the pump-house. After the occurrence there was a smell, but not greater than usual. Apparently, said a witness, the gas percolated through the flues connected with the gas-producers. This was the first fatal accident of this particular kind during the fifteen years he had been foreman. Another witness said that in spite of all precautions taken by the firm, it had not yet been found possible to eliminate the percolation. Plans have been passed by the firm, in order to expel the gases from the room, and prevent them coming through the soil. A verdict of "Accidental death" was returned.

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A Belfast Explosion.—At the monthly meeting of the Belfast Corporation, Mr. Wheeler denied a statement in the Electrical Engineer's report that a recent underground explosion among electric wires in Rosemary Street was due to a defective gas-pipe. As a fact, he said, the defect in the gas-pipe was caused by an imperfectly insulated electric wire. Alderman Craig said this was the third explosion of the kind that had occurred in the same thoroughfare, and each time the trouble was attributed by the Gas Committee to the gas-main, though it was really an electric wire which was at fault. Mr. Stirling recalled that a recent fire at Fisherwick Place arose out of a piece of electric work which set fire to a gas-pipe. Alderman Craig afterwards stated that he understood the Engineer admitted he was mistaken in attributing the explosion to the gas-pipe, and that it was really due to an electric wire.

Wakefield Water Bill.—At a public meeting at Wakefield, those present unanimously approved of the promotion of the Bill of which notice has been given, for various purposes in connection with the Corporation water undertaking. In detailing the proposals at length, Mr. George Foster (the Chairman of the Water Committee) said it was well known that, besides supplying pure water for the 55,000 inhabitants of Wakefield, the Corporation also supplied a large area outside the city. It was proposed to abandon the construction of the Booth Dean reservoir at Rishworth, for which powers had already been obtained. This reservoir would have cost at least £60,000; whereas under the modified scheme an additional 500,000 gallons of water would be obtained daily at a capital charge of only £20,000. It would have taken at least seven years to construct the reservoir; while the proposed scheme could be completed in two years. It was not intended to increase the catchment area.

Rochdale Gas Workers Demand Increased Remuneration.—At the monthly meeting of the Rochdale Town Council on Friday, further reference was made to the application some time ago by the National Union of Gas Workers and General Labourers for increases of wages to about 150 men, and for various alterations in the number of hours worked. Mr. Walker (the Chairman of the Gas Committee) informed the members that the National Union of Corporation Workers requested that the bonus now paid to members should be added to their wages. The original application of the National Union of Gas Workers would have involved an increase in the present wages of £886, in addition to the bonus, or a total of £1450. Part of this increase was due to the claim of certain men to be put on an eight-hour shift, and for the curtailment of the number of hours worked per week. The Committee did not think that the present was an opportune time for conceding the whole of these alterations, but rather that it was one when every citizen should put forth all his energies for the general welfare of the country. After carefully considering the applications, the Committee granted certain concessions which represented an addition to the wages bill of, approximately, £780 a year (of which £570 was already being paid in war bonus), leaving the net addition £210. The proposed increases were agreed to.

APPLICATIONS FOR LETTERS PATENT.

18,072.—KEITH, J. & G., "Gas-furnaces." Dec. 28.
18,092.—TWOMEY, W. K., "Burners." Dec. 28.
18,128.—MACE, B. E., and A. G. SUTHERLAND, LTD, "Coin-freed gas-meters." Dec. 29.
18,154.—ADAMS, M. J., "Gas-incinerator." Dec. 30.
18,161.—IONIDES, A. C., JUN., "Furnaces." Dec. 30.
18,205.—SOUTH METROPOLITAN GAS COMPANY and CHANDLER, D., "Gas-furnaces." Dec. 31.
18,217.—GRENFELL, J. G., "Fluid-pressure regulators." Dec. 31.
18,218.—SEFTON-JONES, H., "Producers for water gas." A communication from the Dellwik-Fleischer Wassergas G.m.b.H. Dec. 31.

Wath-on-Dearne Water-Works.—At a meeting of the Wath-on-Dearne Council last week, a report was given of the first year's working of the new water extensions. During last year (when the new pumping plant was in operation), the consumption increased 9 per cent. The amount of coal consumed was 668 tons, as against 1460 tons in 1914—a saving of 772 tons. There was also a saving on wages of attendants at the pumping-station. For the first year's working of the new pumping plant, the economies effected could be represented at £593 in revenue and running charges. The pumping plant contract amounted to £2264; and a fifteen years' loan had been granted, and the money borrowed at 4½ per cent. The plant would pay for itself in economies effected before January, 1919, or in three years from now. The extensions, it was further reported, had been finally completed at a cost of £11,679, or £216 less than the estimated cost.

Oldbury Public Lighting.—At a meeting of the Oldbury District Council last Friday, under the presidency of Mr. J. W. D. Pratt, the Public Works Committee recommended that the following revised charges be paid to the Gas Department in respect of public lighting as from April 1 next, to include maintenance charges: Lamps not lighted, £1 per lamp per annum; lamps lighted, £3 5s. per lamp per annum. Mr. Davies explained that these revised charges were suggested by the Gas Committee to help them to meet the additional heavy expenditure that was being imposed upon them in connection with the manufacture of gas. There were in the Oldbury district 802 lamps, of which 380 would be lighted; and the revision of the charges would mean an increased expenditure on street lighting of £400 a year. The figures were put before the Public Works Committee, who felt that it was impossible for the Gas Department to continue to supply gas for public lighting at the old rates; and the revised charges would only show a small margin of profit. If there should be any material profit through the increased charges, the Gas Department had agreed to make some grant towards the relief of the district rates. The revised charges were adopted.

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Acknowledgment has to be made of the receipt of boldly figured date blocks (bearing well-selected quotations) from Messrs. Simon-Carves, Limited, and Messrs. Brotherton and Co.; and also desk and wall calendars from Messrs. Stewarts and Lloyds and Messrs. Bale and Church.

At a meeting of the Haworth District Council last week, the Chairman, in reviewing the administration of the district, said gas was from 8d. to 1s. 6d. per 1000 cubic feet cheaper in the township than in surrounding places, water was charged for only at a nominal rate, and the general district rate was 1s. 3d. in the pound lower than any in the neighbourhood. He could not see the necessity for increases in any department in the coming year.

The Sutherland Meter Company, Limited, write: "The Directors, Messrs. G. E., J. F., & A. C. Wright, called an extraordinary meeting of shareholders, at which they expressed their wish to retire from the Board; and they put before the shareholders their recommendation that the vacancies should be filled by appointing as Directors Mr. A. C. Frost (General Manager), Mr. R. G. Wootton, and Mr. G. F. Birtles. The resolution was carried, and the Directors then held a meeting, when the new members were duly appointed and took over the control of the Company."

The San Paulo (Brazil) Gas Company, Limited, announce that the Canadian and General Finance Company, Limited, will in future act as their purchasing and transfer agents, and that the registered offices will consequently be removed from Caxton House, Westminster, to 34, Bishopsgate, E.C.

The fusing of a main circuit was responsible for the cutting-off of the electric current at Shrewsbury last Saturday week, just at a time when the shops and places of entertainment were busy. Picture houses had to close before the completion of their programmes; but the theatre was more fortunate, through being in a position to continue the performance with the aid of gas. In some parts of the town two hours elapsed before the current was restored.

Mr. J. Lord asks us to mention that he has resigned his position as Chairman and Joint Managing Director of the "Manchester Furnaces, Limited," and started a new Company under the name of "J. Lord, Limited," for the manufacture of gas-furnaces. He has taken over the whole of the Continental business of Manchester Furnaces, Limited, and at the present time is erecting furnaces for the French, Italian, and Belgian Governments. The offices of "J. Lord, Limited," are at No. 40, St. Peter's Gate, Stockport. A series of new types of furnaces is being developed by them.

STOCK MARKET REPORT.

THE first week of the New Year on the Stock Exchange was decidedly gratifying on the whole, though not all markets were equal participants. Business was more lively than it had been for some time past, and the predominant tendency was cheerful to a marked degree. There was a slight check before all was finished—not unusual after a big rise—but recovery was apparent on the closing day. There was no pressure to sell—indeed, business would have been more plentiful if stock had been less scarce. The War Loan was firm on the whole, and Consols were better; and, having regard to competing attractions for the investment of money, the position was very fair. A welcome feature was the progress of Home Rails, which took a strong line all through the week. The American Market was weakened by special factors, but steadied before the wind-up. In the Foreign Market, the chief feature was the continued demand for the French Loan, which now commands a good premium. Some little profit-snatching in mid-week did it no harm. Japanese and Argentine issues were also in favour. South Africans had a very good time. In the Miscellaneous group there were many noteworthy points. In Rubber shares there was a regular rush, and the rise extended to the good, the bad, and the indifferent. The shortage of shipping enhanced values in shares, and armaments and oils were also on the rise. Bank shares materially advanced on the half-year's accounts—the soundness of the policy of a generous writing-down of securities being recognized. Among general topics, it may be noted that Exchequer Bonds are going well. Somewhat in competition with them came the New South Wales Loan, which was not altogether welcomed, and its full subscription (it is believed) is not expected. The issue of small Exchequer Bonds at the post offices opened yesterday—a good move; but whether the people will appreciate it remains to be seen. The Government scheme for dealing with dollar securities is criticized as being overlaid with costly machinery. The Exchange value of the German mark of 11¾d. at New York and Amsterdam is now down to 8¼d. Business in the Gas Market is in a state of inanition. Only three companies were dealt in at all, and some issues had but a single bargain. In the Money Market, rates hardened materially.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 70½, ditto preference 75½, 76, Primitiva 2¼, South Metropolitan 78¾, ditto debenture 60½. On Tuesday, Gas Light ordinary 70¼, 70½, 70⅝, 71, 71¼, ditto maximum 60, ditto preference 75⅝, 76, Primitiva 2 5/16, South Metropolitan 78. On Wednesday, Commercial 4 per cent. 76½, Gas Light ordinary 70, 70¼, 70¾, ditto preference 75¼, 76½, San Paulo preference 83¾, South Metropolitan 78¾. On Thursday, Gas Light ordinary 70⅛, 70½, 70¾, 71, ditto maximum 59½, ditto preference 76½, South Metropolitan 77, 78. On Friday, Commercial 4 per cent. 75½, ditto 3½ per cent. 75, ditto debenture 55, Gas Light ordinary 70¼, 70¾, 71, ditto maximum 60, South Metropolitan 77⅛, 77⅜. On Saturday, Gas Light ordinary 71, ditto maximum 60¼, South Metropolitan debenture 60⅜.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5¾—6¾	5 17 8	..
60,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water: 10 p.c.	29—30	5 6 8	..
878,480	10	,,	7	7/-	B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Pref. 6 p.c.	13¼—14	4 5 9	..
147,240	—	—	—	4	Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	26/-	Brentford Consolidated	261—266	5 5 3	..
880,000	,,	,,	†11	55/-	Do. New	204—209	5 5 3	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—213	5 3 4	..
244,300	,,	,,	8	7½	Do. A Ord. Stk.	154—159	5 0 3	..
630,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1¾—2¼	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75½—76½
550,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	75
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	55
300 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,370	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke: 4 p.c. Ord.	98—102	4 15 6	70—71½
2,600,000	,,	,,	3½	3½	3½ p.c. max.	76—79	4 8 7	59½—60½
4,062,335	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	75½—76½
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	,,	,,	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7¼	7½	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	6½	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	..
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,342	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord.: A	211—213	4 18 11	}
718,100	,,	,,	7		B	146—148	4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4¾	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4½	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8/2	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5¼—6	6 18 4	2¼—2 5/16
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4¾—5	5 0 0	..
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo: 6 p.c. Pref.	10¾—11	5 9 1	8½
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	233—234	4 9 8	..
209,984	,,	,,	10	10	Do. B	232—234	4 9 8	..
533,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10¾—11¼	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77¼—78¾
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	73¼—74½	4 0 6	60¾—60⅝
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
639,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District: A 5 p.c.	136—138	5 8 8	..
742,375	,,	,,	6	6	B 3½ p.c.	115—117	5 2 7	..
181,355	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	103½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8¾	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
265,696	,,	,,	6¾	63/9	,, B 3½ p.c.	123—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—116	5 2 0	..
352,000	,,	,,	6¾	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6¾	63/9	Epsom 5 p.c.	121—126	5 6 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS AND WATER ENGINEER. Mansfield Corporation. Applications by Jan. 18.
OUTDOOR SUPERINTENDENT. Cheltenham Gas Company. Applications by Jan. 15.
CLERK. No. 6132.
CLERK AND COLLECTOR. No. 6134.
WORKING FOREMAN. No. 6135.
WORKING FOREMAN. No. 6136.
MECHANIC. Stretford Gas-Works.
STOKER. King's Lynn Gas-Works.
STOKER. Willey and Co., Exeter.
STOKERS. Tonbridge Gas-Works.
YARDMAN. King's Lynn Gas-Works.

Appointment Wanted.

COMMERCIAL TRAVELLER. No. 6133.

Plant, &c. (Second Hand), for Sale.

GAS EXHAUSTER. No. 6137.

Plant, &c. (Second Hand), Wanted.

CONDENSERS, EXHAUSTERS, AND MOUTHPIECES. Prestonpans Gas-Works.

Patent Licence.

INCANDESCENT MANTLE MANUFACTURE. Haseltine, Lake, and Co., 28, Southampton Buildings, Chancery Lane, W.C.

Sales of Stocks and Shares.

HAYWARDS HEATH GAS COMPANY. By tender. Jan. 14.

Meetings.

COMMERCIAL GAS COMPANY. Cannon Street Hotel. Feb. 17. Twelve o'clock.
TOTTENHAM LIGHT, HEAT, AND POWER COMPANY. 689 High Road, Tottenham. Feb. 5. Three o'clock.

TENDERS FOR

Fire-Clay Goods.

MANSFIELD GAS DEPARTMENT. Tenders by Jan. 24.

Sulphuric Acid.

LITTLEHAMPTON GAS COMPANY. Tenders by Jan. 28.
MANSFIELD GAS DEPARTMENT. Tenders by Jan. 24.

Tar.

LITTLEHAMPTON GAS COMPANY. Tenders by Jan. 28.
MALVERN GAS DEPARTMENT. Tenders by Jan. 16.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

THE Secretary of the War Office recently issued the following order:—

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the Office to any neutral country.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1916 are reminded that this can only be done before the end of January.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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See Illustrated Advertisement, Nov. 16, p. 354.

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